MATERIA MEDICA

PHARMACY, PHARMACOLOGY
AND
THERAPEUTICS

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AND
THERAPEUTICS

BY

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PREFACE

TO

THE FOURTEENTH EDITION

In this Edition the alterations are extremely numerous, for the book has been throughout adapted to the new edition of the British Pharmacopœia published December 31, 1914. The chief changes are:—

(1) All the Indian and Colonial drugs and preparations are now placed in the body of the book instead of in an Addendum.

(2) All doses are given in both Imperial and Metric Measures.

(3) The strengths of many preparations have been altered. The chief are the following:—

Acetum Scillæ is twice
— Urgineæ "
Acidum Nitricum Dilutum is $\frac{3}{5}$
Emplastrum Belladonnæ is $\frac{1}{2}$
Injectio Cocainæ Hypodermica is $\frac{1}{2}$
— Morphinæ Hypodermica is $\frac{1}{2}$
Linimentum Hydrargyri is $\frac{3}{5}$
Pilula Phosphori is $\frac{1}{2}$
Spiritus Juniperi is twice
Syrupus Ferri Iodidi is $\frac{2}{3}$
Tabellæ Trinitrini is $\frac{10}{13}$
Tinctura Aconiti is twice

the strength
of that in
B. P. 1898

Tinctura Belladonnæ is $\frac{7}{10}$
— Camphoræ Composita is $\frac{11}{10}$ (morphine)
— Colchici is $\frac{1}{2}$
— Digitalis is $\frac{4}{5}$
— Nucis Vomica is $\frac{1}{2}$
— Opii is $\frac{4}{5}$
— Opii Ammoniata is $\frac{9}{10}$
— Picrorhizæ is twice
— Strophanthi is four times
Trochiscus Acidi Carbolici is $\frac{1}{2}$
Unguentum Hydrargyri is $\frac{3}{5}$
— Hydrargyri Ammoniati is $\frac{1}{2}$
— — Compositum is $\frac{3}{5}$
— — Subchloridi is twice

the strength of that in B. P. 1898

(4) The following substances have been added to the Pharmacopœia :—

Acetone
Acetylsalicylic Acid (aspirin)
Diluted Hydriodic Acid
Picric Acid
Adrenalin
Barbitone (veronal)
Benzamine (eucaine) lactate
Calcium Lactate
Cantharidin
Cassia Fruit
Chloral Formamide (chloralamide)
Cresol
Diamorphine (heroin) hydrochloride
Ethyl Chloride
Saccharated Iron Phosphate
Glucose
Guaiacol
— Carbonate
Hexamine (urotropin)
Ipomœa Root
Liquor Formaldehyde (formalin)
Methyl Salicylate (artificial oil of wintergreen)
Methylsulphonal (trional)
Pelletierine Tannate
Phenolphthalein (purgen)
Resorcin
Senna Fruit
Benzoated Suet
Acid Sodium Phosphate
Bromide of Strontium
Theobromine and Sodium Salicylate (diuretin)
Zinc Oleostearate

(5) The following substances have been deleted from the Pharmacopœia 1898 :—

Acalypha and preparations
Acetum Ipecacuanhæ
Gallic Acid
Adhatoda and preparations
Ammonium Phosphate
Andrographis and preparations
Black Antimony

Silver Oxide
Aristolochia and preparations
Arnica root and preparations
Azadirachta Indica and preparations
Bismuth Oxide
Calotropis and preparations
Cantharis and preparations
Caoutchouc and preparations
Cerium Oxalate
Cimicifuga and preparations
Cissampelos and preparations
Coca Leaves and preparations
Conium Leaves and Fruit and preparations
Coscinium and preparations
Crocus and preparations
Cusparia bark and preparations
Elaterinum and preparations
Elaterium
Emplastra Ammoniaci Hydrargyro, Opii, and Plumbi Iodidi
Extracta Anthemidis
— Belladonnæ Viride
— GlycyrrhizæSpirituosum
— Jalapæ
— Taraxaci Liquidum
Phosphate of Iron
Arseniate of Iron
Figs
Galbanum and preparations
Gamboge and preparations
Indian Gamboge
Granati Cortex and preparations
Hemedismus Root and preparations
Hygrophilia and preparations
Infusum Serpentariæ
Jaborandi Leaves and preparations
All Concentrated Liquors
Liquor Ferri Acetatis
— Ferri Pernitratis
— Sodii Ethylatis
— Thyroidei
Lupulus and preparations
Lupulinum
Mezereon Bark
Mistura Creosoti
— Spiritus Vini Gallici
Musk
Mylabris and preparations
Oil of Pimento
Poppy Capsules
Pareira Root and preparations
Physostigmine Seeds and preparations
Picrotoxin
Pimento and preparations
Black Pepper
Burgundy Pitch and preparations
Lead Carbonate and preparations
Prunes
Elder Flowers and preparations
Sarsaparilla Root and preparations
Sassafras Root and preparations
Scammonium
Compound Scammony Pill
Mustard and preparations
White and Black Musta Seeds
Sulphocarbolates

Sodium
Spiritus Ætheris Compositus
Stramonium Seeds and preparations
Succus Belladonnæ
— Hyoscyami
Iodide of Sulphur and preparations
Sumbul Root and preparations
Frankincense
Tincture of Aloes
Tinospora and preparations
Toddalia and preparations
Sodium Bicarbonate Lozenge
Tylophora Leaves
Ointments of the Glycerin of Subacetate of Lead and of Acetate of Lead
Veratrine and preparations

(5) The names of the following articles and preparations have been altered :—

Former names, 1898 *or* 1900.	*Present Names*, 1914.
Adeps	Adeps Preparatus
Aloe Barbadensis Aloe Socotrina	Aloe
Alumen	Alumen Purificatum
Benzol	Benzenum
Borax	Borax Purificatus
Carbonis Bisulphidum	Carbon Didulphidum
Eucalypti Gummi	Kino Eucalypti
Extractum Aloes Barbadensis	Extractum Aloes
Extractum Belladonnæ Alcoholicum	Extractum Belladonnæ Siccum
Extractum Cascaræ Sagradæ	Extractum Cascaræ Sagradæ Siccum
Extractum Euonymi Siccum	Extractum Euonymi
Extractum Hyoscyami Viride	Extractum Hyoscyami
Extractum Nucis Vomicæ	Extractum Nucis Vomicæ Siccum
Extractum Opii	Extractum Opii Siccum
Extractum Viburni Prunifolii Liquidum	Extractum Viburni Liquidum
Ferrum Tartaratum	Ferri et Potassii Tartras
Hydrargyri Oleas	Hydrargyrum Oleatum
Linum	Lini Semina
Linum Contusum	Lini Semina Contusa
Liquor Iodi Fortis	Tinctura Iodi Fortis

Former names, 1898 *or* 1900.	*Present names*, 1914.
Liquor Magnesii Carbonatis	Liquor Magnesii Bicarbonatis
Oleum Gynocardiæ	Oleum Chaulmoogræ
Oleum Pini	Oleum Abietis
Oleum Terebinthinæ	Oleum Terebinthinæ Rectificatum
Pilula Aloes Barbadensis Pilula Aloes Socotrinæ	Pilula Aloes
Rhei Radix	Rhei Rhizoma
Senna Alexandrina Senna Indica	Sennæ Folia
Soda Tartarata	Sodii et Potassii Tartras
Sodii Arsenas	Sodii Arsenas Anhydrosus
Syrupus Codeinæ	Syrupus Codeinæ Phosphatis
Tinctura Colchici Seminum	Tinctura Colchici
Tinctura Iodi	Tinctura Iodi Mitis
Trochiscus Eucalypti Gummi	Trochiscus Kino Eucalypti
Unguentum Gynocardiæ	Unguentum Chaulmoogræ
Unguentum Hydrargyri Oleas	Unguentum Hydrargyri Oleati

(6) The composition of a few of the preparations has been altered. As a rule these alterations are not of much importance; they will be referred to in the text.

W. HALE WHITE.

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MATERIA MEDICA

Materia Medica is so wide a term that it is difficult to define. It includes the following:

(*a*) **Materia Medica proper,** sometimes called Pharmacognosy. This is the knowledge of the natural history, physical characters, and chemical properties of drugs.

(*b*) **Pharmacy.**—This is the science and art of the preparation and combination of drugs, so as to render them fit for administration.

(*c*) **Pharmacology.** This is the science which treats of the actions of drugs on the body both in health and disease. A subdivision of it is Pharmacodynamics, which is the science of the physiological action of drugs in health. The science which studies the effects of doses large enough to endanger life is **Toxicology.**

(*d*) **Therapeutics** is the science and art of alleviating or curing disease. Many authors do not include this under the term Materia Medica. Therapeutics is either

(1) **Rational,** when we have sufficient knowledge of the disease and the pharmacological action of the remedy to know why it should be of benefit, *e.g.* The use of digitalis for mitral disease.

(2) **Empirical**, when our knowledge is insufficient to tell us why the remedy is efficient, *e.g.* The use of salicylates for rheumatic fever.

Therapeutics ought not to be included in the term Materia Medica, for that treats only of drugs; but Therapeutics, properly speaking, is concerned with all means of alleviation.

General Therapeutics is a subdivision of Therapeutics; it is the science and art of alleviating disease by such remedies as are not drugs, *e.g.* diet, climate, baths, venesection, and cupping. In this work we shall consider only that part of Therapeutics which is concerned with drugs.

A Pharmacopœia is a book published by some authorised body, generally constituted by law. This book describes most of the drugs in common use, and gives directions concerning the making of preparations from them. The pharmacopœias and the authorities publishing them differ in different countries. The **British Pharmacopœia** is published by the General Medical Council. The last edition appeared in 1914. As new drugs are discovered they are, if of sufficient use, included in new editions of the Pharmacopœia. Everything contained in the Pharmacopœia is said to be "official." The abbreviation for "British Pharmacopœia" is "**B. P.**"

The Council of the Pharmaceutical Society of Great Britain have published a valuable book, "The British Pharmaceutical Codex," containing many preparations not in the "British Pharmacopœia." Some are mentioned in this book. When prescribed, B. P.C. should be put in a bracket after them.

MATERIA MEDICA PROPER.

As much of this as the student need know will be mentioned under each drug.

PHARMACY.

Pharmacy is for the most part carried out by the manufacturing and dispensing chemist. The medical student should, however, be acquainted with the simpler processes, as he may have to perform them. They are best learnt in the dispensary. An elementary knowledge of chemistry will enable him to understand most of the terms used in pharmacy, but the following should be noticed.

Alkaloids are bodies having the following characteristics :

(1) They are the active nitrogenous principles of organic bodies.

(2) They are compound ammonias : that is to say, one or more atoms of hydrogen in ammonia (NH_3) are replaced by various radicals.

(3) They combine with acids to form crystalline salts without the production of water.

(4) They are alkaline, turning red litmus paper blue.

(5) Very few are liquid, such as pilocarpine, coniine, nicotine, sparteine, lobeline. Liquid alkaloids nearly always contain only carbon, hydrogen, and nitrogen.

(6) The solid ones are colourless, crystalline, and contain oxygen.

(7) They are sparingly soluble in water, readily so in alcohol.

(8) The solutions are intensely bitter.

(9) Most of them are closely related to pyridine, and some may be synthetically prepared from pyridine bases.

Names of alkaloids terminate in English in *-ine* (quinine), in Latin in *-ina* (quinina). Examples in B. P.: Atropine, Cocaine, Strychnine, &c. Except in the case of Aconitine, Atropine, Caffeine, Cocaine, Codeine, and Strychnine, salts of alkaloids, but not alkaloids themselves, are official. Morphine is, however, official in the Appendix to the Pharmacopœia.

Glucosides are crystalline bodies which when acted upon by acids, or chemical ferments (enzymes), split up into sugar (nearly always glucose) and other substances (alcohols, aldehydes, phenols, &c.), different in each case.

Example in B. P.: Salicinum. Many varieties of tannic acid exist in plants as Glucosides.

Saponins are a group of glucosides forming a clear solution in water, which froths on shaking, and may be used to emulsify oils and resins. Senega contains a powerful saponin.

Neutral Principles are indifferent proximate crystalline principles whose chemical characters have not been determined.

Example in B. P.: Aloinum.

Fixed Oils are ethereal salts formed from the higher fatty acids and the trihydric alcohol glycerin, $C_3H_5(OH)_3$. At ordinary temperatures they remain liquid. The usual fatty acids entering into the composition of fixed oils are oleic, palmitic, and stearic.

Example: Olive oil consists of a mixture of a combination of oleic acid ($C_{18}H_{34}O_2$) with glyceryl (C_3H_5) and palmitic acid ($C_{16}H_{32}O_2$) with glyceryl. That is to say, ordinary olive oil is a mixture of two oils having the formulæ $C_3H_5(C_{18}H_{33}O_2)_3$ and $C_3H_5(C_{16}H_{31}O_2)_3$ respectively. When acted upon by caustic alkalies or metallic oxides fixed oils form soaps (oleates, palmitates, or stearates of metals) and glycerin. This process is called saponification,

$$e.g.\ C_3H_5(C_{18}H_{33}O_2)_3 + 3NaHO = \underset{\text{Hard Soap}\atop\text{Sodium Oleate}}{3NaC_{18}H_{33}O_2} + \underset{\text{Glycerin}}{C_3H_5(OH)_3}.$$

Fixed Oils are obtained from the fruits or seeds of plants, or from animal tissues, by expression or by boiling with water and skimming off the melted oil. When pure they usually are yellow, and float on water; they cause a greasy mark on paper. They are called fixed because they cannot be distilled without decomposition. They are soluble in ether or chloroform.

Liquid fixed oils in B. P. are Olea Amygdalæ, Crotonis, Lini, Morrhuæ, Olivæ, Ricini.

Fats are fixed oils which are solid at ordinary temperatures; if extracted by expression sufficient heat to melt them must be used.

Examples in B. P.: Oleum Theobromatis, Adeps Preparatus.

Waxes are chiefly composed of fatty acids combined with monohydric alcohols homologous with methyl alcohol.

Volatile or Essential Oils only resemble fixed oils in being soluble in the same media. They do not leave a greasy mark on paper. They are mostly inflammable, and lighter than water. They are highly aromatic, and sufficiently soluble in water to impart their odour and taste to it. Most are prepared by distillation that is, by passing a current of steam through the substance from which they are extracted, the steam is condensed, and the oil either floats to the top or sinks to the bottom of the water. A few, as oil of lemon, are obtained by expression from a fruit. Their composition varies very much. They contain Aldehydes (Cinnamic Aldehyde, in oil of cinnamon), Phenol derivatives (Eugenol, in oil of cloves), Esters or Ethereal Salts (Methyl Salicylate, in oil of wintergreen), Alcohols (Menthol, in oil of peppermint), or Ketones (Carvol, in oil of caraway), generally associated with Terpenes (*see* oil of turpentine) of varying composition, and which may be the chief constituent of the oil (*e.g.* the Terpenes in oils of turpentine).

Examples in B. P.: Olea Anethi, Anisi, Cinnamomi, Lavandulæ, &c.

Resins are very complex bodies. They are among the products of oxidization of volatile oils. They contain many indifferent substances and acids. They are soluble in alkalies, forming resin soaps. Hence the alkali in Decoctum Aloes Compositum, Tinctura Guaiaci Ammoniata, and Tinctura Valerianæ Ammoniata. They are insoluble in water, but not in alcohol, therefore they may be prepared by extraction with alcohol and precipitation with water; also this is the reason for the precipitate which falls when water is added to a resinous tincture.

The B. P. resins are Resina, Resina Guaiaci, Jalapæ Podophylli and Podophylli indici.

Oleo-resins are natural solutions of resins in volatile oils.

Those in B. P. are Copaiba and Terebinthina Canadensis.

Balsams are mixtures of oleo-resins with benzoic acid or cinnamic acid, or with both.

Those in B. P. are Benzoinum, Balsamum Peruvianum Balsamum Tolutanum, Styrax Præparatus.

Gums are exudations from the stems of plants containing one or more of:

(*a*) Arabin or soluble gums, *e.g.* Acacia.
(*b*) Bassorin or partially soluble gums, *e.g.* Tragacantha.
(*c*) Cerasin or insoluble gum.
Solutions of gum are precipitated by alcohol.

Gum-resins are exudations from plants consisting of a mixture of gums and resins. When they are rubbed with water the gum dissolves, and the resin remains mechanically suspended in the solution.

The B. P. gum-resins are Ammoniacum, Asafetida, and Myrrha.

An Emulsion consists of finely divided particles of an oil, fat, or resin suspended in a viscous liquid. When a heavy powder, *e.g.* bismuth subnitrate, is suspended in such a liquid, the result is called a suspension.

Mucilago Acaciæ and M. Tragacanthæ are frequently used to form emulsions. Mucilago Acaciæ should be recently prepared. It is incompatible with iron perchloride, borax, and lead subacetate.

Lotio Hydrargyri Nigra is an example in B. P. of suspension.

Emulsions are coagulated by acids, an undue proportion of metallic salts, and alcoholic liquids.

PHARMACEUTICAL PROCESSES.

Many of these, as filtration, precipitation, &c., need no explanation, but the following require a few words.

Levigation consists in reducing a drug to a very fine powder by triturating it with a little water and drying the resulting paste.

Elutriation consists in diffusing an insoluble powder in water, letting the heavier part settle, then decanting the supernatant fluid. The heavier powder in this is allowed to settle, the fluid decanted, and so on until a fluid containing powder of the required fineness is obtained.

Lixiviation consists in the extraction with water of the soluble matter of the ashes of anything which has been ignited, the solution being called a "lye."

Maceration consists in leaving coarsely powdered solid organic substances in contact for some time, at the temperature of the atmosphere, with a liquid in a vessel which is frequently agitated. The resulting solution is poured off and added to the liquid obtained from the remaining substance by pressure. The whole may be concentrated by heat. Many extracts and tinctures are made by maceration.

Percolation is a process for obtaining the soluble constituents of a drug by the descent of a solvent through it. The drug to be percolated is packed in a tall vertical cylinder, tied over at its lower end with muslin. The percolating fluid, or **menstruum**, is poured in at the top of the cylinder, and as it drops out through the muslin it is collected. The **Marc** is the material after its exhaustion by maceration or percolation. Many liquid extracts, and tinctures of vegetable drugs are prepared by percolation.

Repercolation consists in using the liquid obtained by percolating a substance as the menstruum for percolating a second portion of the same substance, and using the liquid from this second percolation as a menstruum for percolating a third portion of the same substance, and so on as often as may be desired. The liquid extract of Belladonna is an example of repercolation.

Scaling. Scale preparations are made by drying concentrated solutions of drugs on glass plates. The solid left behind forms a thin film on the plate, and this film is broken up. Some preparations of iron are scale preparations.

Standardizing. The Pharmacopœia directs that certain preparations made from vegetable drugs shall be standardized—that is to say, shall be made to contain a certain fixed proportion of the chief active principle. The standardized preparations are (N.B.—1 per cent. expressed concretely in the metric system is 1 gramme in 100 millilitres; in the British system, 1 grain in 110 minims)—

Opium to make Tincture or Extract must contain not less than 7·5 per cent of Morphine. Otherwise not less than 9·5 and not more than 10·5 per cent.

Extractum Opii Siccum containing 20 per cent. of Morphine.

Extractum Opii Liquidum containing 0·75 per cent. of Morphine.

Tinctura Opii containing 1 per cent. of Morphine.

Tinctura Camphoræ Composita containing 0·05 per cent. of Morphine.

Tinctura Opii Ammoniata containing 0·1 per cent. of Morphine.

Nux Vomica powdered must contain 1·25 per cent. of Strychnine.

Extractum Nucis Vomicæ Siccum containing 5 per cent. of Strychnine.

Extractum Nucis Vomicæ Liquidum containing 1·5 per cent. of Strychnine.

Tinctura Nucis Vomicæ containing 0·125 per cent. of Strychnine.

Belladonna Leaves must yield not less than 0·30 per cent. of alkaloids.

Tinctura Belladonnæ containing 0·035 per cent. of total alkaloids of the leaves.

Extractum Belladonnæ Siccum containing 1 per cent. of total alkaloids of the leaves.

Extractum Belladonnæ Liquidum containing 0·75 per cent. of total alkaloids of the root.

Emplastrum Belladonnæ containing 0·25 per cent. of total alkaloids of the root.

Linimentum Belladonnæ containing 0·375 per cent. of total alkaloids of the root.

Unguentum Belladonnæ containing 0·6 per cent. of total alkaloids of the root.

Extractum Hyoscyami containing 0·3 per cent. of the alkaloids of Hyoscyamus leaves.

Extractum Cinchonæ Liquidum containing 5 per cent. of total alkaloids.

Tinctura Cinchonæ containing 1 per cent. of total alkaloids.

Tinctura Cinchonæ Composita containing 0·5 per cent. of total alkaloids.

Tinctura Aconiti containing 0·04 per cent. of the ether soluble alkaloids of Aconite root.

Linimentum Aconiti containing 0·2 per cent. of the ether-soluble alkaloids of Aconite root.

Extractum Ipecacuanhæ Liquidum containing 2·0 per cent. of total alkaloids.

Vinum Ipecacuanhæ containing 0·1 per cent. of total alkaloids.

Aqua Laurocerasi containing 0·1 per cent. of Hydrocyanic Acid.

Tinctura Jalapæ containing 1·5 per cent. of jalap resin.

Extractum Hydrastis Liquidum containing 2 per cent of Hydrastine.

Emplastrum Calefaciens containing 0·02 per cent. of Cantharidin.

Emplastrum Cantharidini containing 0·2 per cent. of Cantharidin.

Extractum Filicis Liquidum must contain not less than 20 per cent. of Filicin.

Physiological Standardization.—When a drug is a known chemical body of constant composition, *e.g.* arsenious acid, or its active principle is a definite chemical body, *e.g.* strychnine in nux vomica, preparations of the drug can be standardized by chemical means; but, when the activity is due to a body or bodies which the chemist cannot estimate quantitatively, the attempt is made to estimate the strength of various preparations by observing the minimum fatal dose of each, when administered under similar conditions, to animals of the same species and weight. Such investigations have been made principally with digitalis, and it has been found that the amount of active principle in different specimens of the tincture is variable. Or the drug may be physiologically standardized by observation of the degree of some striking physiological effect, *e.g.* preparations containing adrenalin (the active principle of suprarenal medulla) may be standardized by their effect on blood pressure.

WEIGHTS. MEASURES. SYMBOLS.

Imperial System.

WEIGHTS (Avoirdupois Weight).

1 grain	. . .	Symbol,	gr.
437·5 grains	= one OUNCE	,,	oz.
16 ounces (7000 gr.)	= one POUND	,,	℔

The Scruple (20 grains, symbol ℈) is rarely used, and the Drachm (60 grains, symbol ʒ) is sometimes used, but neither is official. What is known as Apothecaries' Weight, in which the ounce = 480 grains, is not official, but is sometimes used in America.

MEASURES OF CAPACITY.

1 minim .	. . . .	Symbol,	min.
60 minims . . .	= one FLUID DRACHM	,,	fl. dr.
8 fluid drachms (480 minims)	= one FLUID OUNCE	,,	fl. oz.
20 fluid ounces . . .	= one PINT	,,	O
8 pints	= one GALLON	,,	C

The following symbols are often used but they are not official: ♏ for minim; ʒ for fl. dr.; ℥ for fl. oz. The last two are even sometimes used ʒ to represent 60 gr. and ℥ to represent oz., but this is much to be deprecated.

Occasionally ʒ and ℥ are written f ʒ and f ℥ when they stand for fluid drachms and fluid ounces.

Relations of Measures to Weights.

1 minim	is the measure	at 16·7° C. (62° F.) of	0·911	grain of	water.
1 fluid drachm	,,	,,	54·687	,,	,,
1 fluid ounce	,,	,,	437·5 (the avoirdupois ounce)	,,	,,
1 pint	,,	,,	8750·0	grains of	water.
1 gallon	,,	,,	70000·0	,,	,,

A **1 per cent. solution** is approximately **a grain in 110 minims**, for 110♏ (strictly 109·7143) of water at 16·7 C weighs 100 gr.

In the pharmacopœial description of the various proportions which several parts of a compound bear to one another, the word parts means parts by weight; the term fluid parts signifies the volume of an equal number of parts of water.

Metric System. This, which is as follows, is official on the Continent and in the B. P. for the making of drugs and preparations, and, together with the Imperial, for doses.

WEIGHTS.

1 milligramme (Mg.) = 0·001 gramme.
1 centigramme (Cg.) = 0·01 "
1 decigramme (Dg.) = 0·1 "
1 gramme (G.) = weight of 1 Millilitre or Mil which is 1 cubic centimetre of distilled water at 4° C. Abbreviation, often used, grm.
1 dekagramme = 10·0 grammes.
1 hectogramme = 100·0 "
1 kilogramme = 1000·0 " Abbreviation, kilo.

MEASURES OF CAPACITY.

1 centimil (Cl.) = the vol. at 4° C. of 1 centigramme of water.
1 decimil (Dl.) = " " 1 decigramme "
1 millilitre or mil (Ml.) = " " 1 gramme "
1 centilitre = " " 10 " "
1 decilitre = " " 100 " "
1 litre = " " 1000 " (1 kilo.) "

N.B.—1 cubic centimetre (abbrev. c.c.) is the same thing as one millilitre.

Conversion of British to Metric.

WEIGHTS.

1 grain = 0·0648 G.
1 ounce = 28·3495 "
1 pound = 453·5924 " (rather under ½ a kilo.).

MEASURES.

1 minim = 0·059 mil.
1 fluid drachm = 3·55 "
1 fluid ounce = 28·412 "
1 pint = 568·245 " (rather over ½ a litre).
1 gallon = 4·5 litres.

Conversion of Metric to British.

WEIGHTS.

1 milligramme = 0·015432 grain.
1 centigramme = 0·154 grain.
1 decigramme = 1·543 grain.
1 gramme = 15·432 grains.
1 kilogramme = 15432·356 " = 2 lb. 3 oz. 119·8 grs.

MEASURES.

1 centimil	= 0·169 minims.
1 decimil	= 1·69 ,,
1 millilitre, mil. or cubic centimetre	= 16·95 ,,
1 litre (1000 c.c.)	= 35·196 fluid ounces, or 1·76 pint.

In prescribing on the Continent all liquids are weighed, the weight of liquids and solids is expressed in grammes, and this word is omitted. Thus

Mag. Sulph. 20 0	= 20 grammes of Magnesium Sulphate.
Hydrarg. Subchlor. 0·5	= half a gramme of Mercurous Chloride.
Tinctura Rhei 1·5	= a gramme and a half of Tinctura Rhei.

The following approximately accurate table will be useful :

17 ♏ = 1 cubic centimetre.
1 fluid drachm = 3·5 grammes (G.), mils, or cubic centimetres (c.c.).
1 ounce = 28·4 .. ..

Approximate Equivalences Imperial and Metric.

WEIGHTS.

Imperial Grains.	Metric Milligrammes.	Imperial Grains.	Metric Decigrammes.
[illegible]	0·3	3	2
[illegible]	0·6	5	3
[illegible]	1·0	8	5
[illegible]	1·5	10	6
[illegible]	2·0	15	10
[illegible]	2·5	20	12
[illegible]	3·0	30	20
[illegible]	4·0	60	40
[illegible]	6·0		
[illegible]	8·0		
[illegible]	12·0		
[illegible]	16·0		
[illegible]	30·0		

Grains.	Grammes.
15	1
30	2
45	3
60	4
120	8
150	10
180	12
240	16
480	32

rains.	Centigrammes.
1	6
2	12
3	20
4	25
5	30
8	50
10	60

VOLUMES.

Minims.	Centimils.	Minims.	Mils.
½	3	15	1
1	6	30	2
2	12	45	3
3	18	60	4
5	30	90	6
8	50	Fluid drachms.	Mils.
		½	2
		1	4
Minims.	Decimils.	2	8
5	3	6	24
10	6	Fluid ounces.	Mils.
15	10	½	15
20	12	1	30
30	18	2	60
60	36	4	120

Domestic Measures.

A TEA-SPOONFUL is rather over a fluid drachm. Usually it is 5 mils, nearly.

A DESSERT-SPOONFUL is about two fluid drachms.

A TABLE-SPOONFUL is about half a fluid ounce. Usually it is very nearly 15 mils.

A WINE-GLASSFUL is about one and a half to two fluid ounces.

A TEA-CUPFUL is about five fluid ounces.

A BREAKFAST-CUPFUL is about eight fluid ounces.

A TUMBLERFUL is about eleven fluid ounces.

A DROP is often taken as being about a minim, but drops vary so much in size that they should never be used for children nor as a measure of powerful drugs. For example, the number of drops in a fluid drachm of the United States syrup of acacia is 44, of water 60, of alcohol 146, of chloroform 250.

PHARMACOPŒIAL PREPARATIONS AND THEIR DOSES.

Most drugs are not, in their natural state, fit for administration. They are either too bulky, too nauseous or contain noxious principles. Preparations suitable for administration are therefore prepared from them according to "official" pharmacopœial directions. The Pharmacopœia states the doses of the various drugs and their preparations which may safely be given to an adult, but these doses are often not rigorously kept in prescribing. They vary with the purpose for which the drug is required and the age of the patient (*see* Prescribing). The following is an account of the preparation of the pharmacopœial preparations, and the attempt has been made to arrange the doses so as to make them easy to remember.

Aceta.—Solutions of the active principles of the drug extracted from it by maceration or digestion with acetic acid (not vinegar). The B. P. contains three.

	Dose.		*Dose.*
Acetum Cantharidini	Ext. use only.	Acetum Scillæ — Urgineæ	5-15m. 3 to 10 decimils

For Acetum Cantharidini both glacial and ordinary acetic acid are used.

Aquæ.—Aqueous solutions impregnated with some volatile substance.

Those in the B. P. directed to be made by distilling the drug with water are

	Dose.		*Dose.*
Aqua Anethi — Anisi Aurantii Floris — Carui Cinnamomi	1-2 fl. oz. 30 to 60 mils	Aqua Fœniculi — Rosæ	1-2 fl. oz. 30 to 60 mils

Aqua Laurocerasi (Standardized 0·1 per cent. of Hydrocyanic Acid) $\frac{1}{2}$–**2** fl. dr.—**2** to **8** mils (note dose).

Aqua Aurantii Floris and Aqua Rosæ are prepared by dilution of commercial orange flower water and commercial rose water, which are made by distillation.

Two are directed to be made by distilling the essential oil with water:

	Dose.		*Dose.*
Aqua Menthæ Piperitæ	1-2 fl. oz. 30 to 60 mils.	Aqua Menthæ Viridis	1-2 fl. oz. 30 to 60 mils.

In actual practice all Aquæ directed to be made from substances containing volatile oils are very often prepared by adding to water the volatile oil with some calcium phosphate or other insoluble powder to diffuse it through the water, which is filtered off and forms the Aqua. The Pharmacopœia allows this method to be used in hot climates.

Two are simple solutions in cold water:

	Dose.		Dose.
Aqua Camphoræ (The solution is aided with alcohol)	1-2 fl. oz. 30 to 60 mils	Aqua Chloroformi (1 in 400)	1-2 fl. oz. 30 to 60 mils

Collodia (collodions).—Solutions of pyroxylin. When applied externally a protective film is formed owing to the rapid volatilization of the solvent. The B. P. contains three:

Collodium Flexile
Collodium Vesicans

Confectiones (Syn. electuaries, boluses, conserves).—Powders made into a paste with sugar or honey, of such a consistency that the powder does not separate, but the mass can be swallowed. The B. P. contains four:

	Dose.		Dose.
Confectio Rosæ Gallicæ	Used as a basis for pills.	Confectio Piperis — Sennæ — Sulphuris	60 to 120 grains, 4 to 8 grms.

Decocta.—Solutions of the non-volatile active principles of vegetable drugs, made by boiling the ingredients in distilled water, in a covered vessel, for from 5 to 10 minutes, and straining. The B. P. contains seven. The dose of each is ½ to 2 fl. oz., 15 to 60 mils. They are—

Decoctum Acaciæ Corticis
—— Agropyri
Aloes Co.
Gossypii Radicis
Corticis
Decoctum Hæmatoxyli
Ispaghulæ
Sappan

Decoctions should be fresh made, as they readily decompose.

Emplastra. Plasters consist of tenacious, pliable, solid substances heated enough to be spread with a heated spatula, generally upon the rough side of sheepskin leather, but sometimes on wash leather, brown holland, silk, or the smooth side of swansdown. They are only used for application to the skin, to which they adhere at the temperature of the body. The following list from the B. P. shows that ALL BUT TWO ARE DERIVED FROM E. PLUMBI:

Emplastrum Plumbi	**Oxide of lead, olive oil, and water.** OLEATE OF LEAD AND GLYCERIN ARE FORMED.
Hydrargyri	**Lead plaster is the basis.**
Resinæ	
Saponis	
Belladonnæ	**Resin plaster, which is made from lead plaster, is the basis.**
Calefaciens	
Cantharidini	Wool fat and beeswax form the basis.
Menthol	**Resin is the chief basis.**

In tropical and subtropical parts of the Empire more or less hard soap, resin, or yellow beeswax may be used to make plasters when prevailing high temperatures otherwise render the basis too soft, but the official proportion of the active ingredient must be maintained.

A plaster is usually prescribed to be of a definite size and shape, but occasionally—*e.g.* in the case of one to put on the breast or behind the ear—the size and shape are left to the dispenser. If it is thought that a plaster will not stick to the skin it may be provided with a margin of adhesive plaster (Emplastrum Resinæ).

Extracta.—Concentrated preparations made by evaporating either the expressed juice of plants, or a solution of the soluble constituents of dried drugs. If the solid extract would otherwise be too poisonous, it may be diluted with sugar of milk, as in Ex. Strophanthi. Some, *e.g.* Ex. Euonymi, contain Calcium Phosphate to keep the extract in the form of a powder. Extracts are of different kinds.

(1) **Fresh Extracts**. Heat the juice expressed from the bruised plant to 100° C. to coagulate the protein, filter, evaporate the filtrate. The B. P. contains Ex Colchici and Taraxaci.

(2) **Aqueous Extracts**. Treat dry drugs with cold, hot, or boiling water, and evaporate to a proper consistency. Examples: Ex. Opii Siccum, &c.

(3) **Alcoholic Extracts**. Treat dry drugs with alcohol with or without the addition of water, and evaporate to a proper consistency. Examples: Ex. Cannabis Indicæ, &c. In some cases the solid extract is made by evaporation of the official liquid extract, *e.g.* Ex. Nucis Vomicæ Siccum.

(4) **Ethereal Extracts**.—The dry drug is percolated with ether (Ex. Filicis Liquidum), or with alcohol and ether (to remove fatty matter) which are distilled off (Ex. Strophanthi).

(5) **Chloroform Extracts**.—In some cases the drug is extracted with chloroform water. This extract is evaporated and alcohol added. Examples:—Ex. Belæ Liquidum and Ex. Glycyrrhizæ Liquidum.

(6) **Liquid Extracts**.—These are aqueous, or alcoholic, or aqueous and alcoholic extracts evaporated to form concentrated liquid solutions of syrupy consistence. They are made by the maceration or percolation processes (p. 7). Occasionally, as in Ext. Belladonnæ Liquidum the percolate is again used to percolate the menstruum two, three, or more times until the required strength is attained. If aqueous, some alcohol may be added to prevent decomposition, or to precipitate any albuminous matter, which is then removed by filtration. Examples: Ex. Ergotæ Liquidum, Hydrastis Liquidum, &c.

Any liquid extract containing less than one fourth its weight of alcohol (90 per cent.) may have the alcohol increased to an amount not exceeding one-fourth the weight of the extract in tropical or subtropical climates if otherwise the preparation would be liable to ferment.

SOLID EXTRACTS.

	Dose.
Extractum Belladonnæ Siccum Cannabis Indicæ Colchici Nucis Vomicæ Siccum Opii Siccum – Strophanthi	¼–1 gr. 16 to 60 milligrms.
Euonymi	1–2 gr. 6 to 12 centigrms.
- Aloes	1–4 gr. 6 to 25 centigrms.
Cascaræ Sagradæ Siccum Colocynthidis Co. Ergotæ Gentianæ -- Hyoscyami Rhei	2–8 gr. 12 to 50 centigrms.
Glycyrrhizæ Krameriæ - Taraxaci	5–15 gr. 3 to 10 decigrms.

LIQUID EXTRACTS.

	Dos
Extractum Ipecacuanhæ	½–2 m 3 to 1 centimil
— Nucis Vomicæ	1–3 m 6 to 1 centimi
- Cinchonæ Hamamelidis — Hydrastis	5–15 m 3 to 10 decim
- Ergotæ Grindeliæ — Opii	5–30 m 3 to 1 decimil
- Picrorhizæ	15–60 m 1 to 4 mil
— Cascara Sagradæ — Glycyrrhizæ Gossypii Radicis Corticis - Kavæ	½–1 f dr. 2 to 4 mil
— Filicis	45–90 m 3 to mils
Agropyri — Belæ Viburni	1–2 fl dr. 4 to mils

— Belladonnæ Liq. is only used to make other preparations.

The dried extracts of Belladonna, Nux Vomica, and Opium, the extract of Hyoscyamus, and the liquid extracts of Belladonna, Nux Vomica, Cinchona, Hydrastis, Ipecacuanha, and Opium are standardized (*see* p. 8).

In hot countries any liquid extract containing less than one-fourth of alcohol may have this increased to an amount not exceeding one-fourth if otherwise liable to fermentation

Glycerina.—Solutions of drugs in glycerin. They are liquid preparations, except Glycerinum Tragacanthæ and Glycerinum Amyli, which are semi solid. All are for external application except Glycerinum Tragacanthæ (used to make pills) and Glycerinum Pepsini. The B. P. contains

Glycerinum Acidi Borici
  Acidi Carbolici
  Acidi Tannici
  Aluminis
  Amyli

Glycerinum Boracis
— Pepsini
— Plumbi Subacetatis
— Tragacanthæ

Infusa. Solutions made by pouring boiling distilled water upon the drug to be extracted, then covering up the vessel, agitating from time to time, usually for a quarter of an hour, sometimes for half an hour, sometimes for one hour, and straining. The filtrate is the infusion.

Inf. **Calumbæ** and Inf. **Quassiæ** are made with **Cold Water**, to prevent the solution of the starch calumba contains and the solution of too much of the bitter principle quassia contains.

Two are compound, viz. Inf. Aurantii Co., Inf. Gentianæ Co.

Two contain acid: Inf. Cinchonæ Acidum, Inf. Rosæ Acidum.

The dose of all is ½-1 fl. oz., 15 to 30 mils, except Inf. Buchu, Ergotæ, Scoparii, all 1-2 fl. oz., 30 to 60 mils, and **Inf. Digitalis 2-4 fluid drachms**, 8 to 16 mils.

Infusions should be made fresh, as they all, except Inf. Caryophylli and Inf. Rosæ Acidum, readily decompose.

Injectiones. Concentrated solutions for injection under the skin. The B. P. contains five

		Strength.
Injectio Apomorphinæ	Hypodermica	(1 per cent.)
.. Cocainæ	,,	(5 per cent.)
.. Ergotæ	,,	(33 per cent. of the Extract of Ergot)
.. Morphinæ	,,	(2·5 per cent. of Morphine Tartrate)
.. Strychninæ	..	(0·75 per cent. of Strychnine Hydrochloride)

Lamellæ. Small thin discs made with gelatin and glycerin, and used to drop into the eye. The B. P. contains four

Lamella Atropinæ (each contains $\frac{1}{5000}$ gr. (0·013 milligrm.) atropine sulphate).

Lamella Cocainæ (each contains $\frac{1}{50}$ gr. (1·3 milligrms.) cocaine hydrochloride).

Lamella Homatropinæ (each contains $\frac{1}{100}$ gr. (0·65 milligrm.) of homatropine hydrobromide).

Lamella Physostigminæ (each contains $\frac{1}{1000}$ gr. (0·065 milligrm.) physostigmine sulphate).

Linimenta. Liniments or embrocations are applications of an oily or spirituous consistence, all of which are intended to be rubbed into the skin except Lin. Aconiti, which is painted on it, and Lin. Calcis, which is simply applied to it. Most contain camphor, many contain olive oil, some contain alcohol or glycerin.

Liquores. Solutions generally of definite chemical bodies, and in which the solvent is usually distilled water. In many cases these are the only constituents. The few exceptions can be found by reference to individual Liquors.

The following strengths should be remembered:

	Strength.		*Strength*
Liquor Arsenicalis	1 p. c., 1 grm. in 100 millilitres, or 1 gr. in 110♏ or about 4½ gr. in 1 fl. oz.	Liquor Morphinæ Hydrochloridi	1 p. c., 1 grm. in 100 millilitres, or 1 gr. in 110♏, or about 4½ gr. in 1 fl. oz.
Arsenici Hydrochloricus		— — Tartratis	
Arsenii et Hydrargyri Iodidi		— Potassii Permanganatis	
Atropinæ Sulphatis		— Sodii Arsenatis	
Morphinæ Acetatis		Strychninæ Hydrochloridi	
		— Trinitrini	

— Hydrargyri Perchloridi 0·1 per cent., 0·1 grm. in 100 millilitres, $\frac{1}{10}$ gr. in 110♏.

The following are the doses of Liquors:

	Approximate Dose.		*Approximate Dose.*
Liquor Trinitrini Atropinæ Sulphatis	½-2m 3 to 12 centimils	Liquor Bismuthi et Ammonii Citratis — Calcis Saccharatus — Ethyl Nitritis Hydrargyri Perchloridi — Morphinæ Acetatis — — Hydrochloridi — — Tartratis	15-60m 1 to 4 mils
Arsenicalis Arsenici Hydrochloricus Sodii Arsenatis Strychninæ Hydrochloridi	2-8m 12 to 50 centimils	Hydrogenii Peroxidi Pancreatis	½-2 fl.dr. 2 to 8 mils.
Ferri Perchloridi	5-15m 3 to 10 decimils	— Ammonii Acetatis — — Citratis — Potassii Permanganatis	2-6 fl.dr. 8 to 24 mils.
Adrenalini Hydrochloricus Ammoniæ Arsenici et Hydrargyri Iodidi Potassæ Sodæ Chlorinatæ	10-30m 6 to 18 decimils	Calcis Magnesii Bicarbonatis	1-4 fl.oz. 30 to 120 mils.

Not used internally:

Liquor Acidi Chromici.
Ammoniæ Fortis.
Calcis Chlorinatæ.
Cresol Saponatus.
Epispasticus.
Ferri Perchloridi Fortis.
— — Persulphatis.
Formaldehydi.
Liquor Formaldehydi Saponatus.
— Hamamelidi.
— Hydrargyri Nitratis Acidus.
— Picis Carbonis.
— Plumbi Subacetatis Fortis.
— — — Dilutus.
— Zinci Chloridi.

Lotiones. Aqueous mixtures for external use, generally applied on lint, or washed on the part. The B. P. contains two:

Lotio Hydrargyri Flava and Lotio Hydrargyri Nigra.

Mella. —Mixtures of some substance with purified honey. The B. P. contains only one:

Mel Boracis.

Misturæ. Liquid preparations consisting of one or more drugs dissolved in water or diffused in a solution of gum or some other thick fluid. The mixture is usually flavoured, and is for internal administration.

Example in B. P. of solutions: M. Sennæ Composita.

Examples in B. P. of suspension: M. Ammoniaci (the gum of which suspends the resin), M. Cretæ, M. Guaiaci (suspended in tragacanth), M. Olei Ricini (emulsified in gum).

The dose of all is ½–1 fl. oz. 15 to 30 mils.

Mucilagines.—Mucilages are aqueous, viscid solutions or partial solutions of gum used for suspending insoluble substances. The B. P. contains three:

Mucilago Acaciæ, Mucilago Gummi Indici, and Mucilago Tragacanthæ.

There is no fixed dose; it is usually about 1 fl. dr.

Olea.—There are many oils in the Pharmacopœia. They are all obtained by distillation or by expression except Oleum Phosphoratum, which is a solution of phosphorus in almond oil. The B. P. olea are

	Dose.		*Dose*
		Oleum Limonis	½–3m 3 to 18 centi mils
Oleum Crotonis	1m 3 to 6 centimils	— Menthæ Piperitæ	
		— Menthæ Viridis	
Ajowan	½–3m 3 to 18 centimils	— Myristicæ	
Anethi		Pimentæ	
Anisi		— Rosmarini	
Anthemidis		— Phosphoratum	1–5m 6 to 30 centi mils
Cajuputi			
Carui			
Caryophylli			
Cinnamomi		— Chaulmoogra	5–20m 3 to 12 decimils
Coriandri		— Copaibæ	
Eucalypti		— Cubebæ	
Graminis Citrati		— Gaultheriæ	
Juniperi		— Santali	
Lavandulæ		Terebinthinæ Rect.	2–10m 12 to 60 [illegible]mils
		— „ „	i dr. [illegible] 15 m[illegible]

	Dose.		*Do*
Oleum Morrhuæ	1—6 fl.dr. 4 to 24 mils.	Oleum Olivæ	Not often given internally.
Ricini		— Abietis	
		Rosæ	
Amygdalæ	Not often given internally.	Rosmarini	
Arachis		Sesami	
Cadinum		Sinapis Volatile	
Lini		Theobromatis	

Oxymella.—Oxymels are preparations containing honey and acetic acid. Besides oxymel the B. P. contains only two:

Oxymel Scillæ and Oxymel Urgineæ. *Dose* ½–1 fl. dr. 2 to 4 mils.

Pilulæ. Solid spherical bodies containing medicinal agents, and intended to be swallowed whole. A mass of the consistence of firm clay is made by beating medicaments together in a mortar. This mass is with a machine divided up and rolled into pills. In order that they may not possess a disagreeable taste, they are often varnished or sugar-coated. Unless the constituents are very heavy, each pill should not exceed 5 grains in weight, and the smaller they are the better. Syrup of glucose, glycerin of tragacanth, and glucanth (tragacanth, 1; glycerin, 3; water, 1; syrup of glucose, 7) are three of the most generally useful excipients. Curd soap is useful for creosote (*q.v.*), and for essential oils if a little calcium phosphate and wheaten flour be added. Confection of roses was formerly very commonly employed. Liquorice powder is a good absorbent. Glycerin is so much used because it attracts moisture and prevents the pill from getting hard, but pills made with much of it soon become very soft: this may be hindered by alcohol. All pills are useless unless so made that they will dissolve in the gastro-intestinal canal. If it is required that they should not be acted upon until they reach the intestine, they should be coated with keratin. Pills may be kept in some powder, as lycopodium, to prevent their sticking together. All purgative pills contain aloes. All pharmacopœial pills are given in doses of about 4 to 8 grains (25 to 50 centigrms.), except

Pilula Phosphori. *Dose* 1-4 gr. 6 to 25 centigrms.
Plumbi cum Opio. } *Dose* 2-4 gr.—12 to 25 centigrms.
Saponis Composita. }
Ferri. *Dose* 5-15 gr.—3 to 10 decigrms.

Pulveres. Powders are mixtures of finely powdered drugs. The best diluent for powders is sugar of milk, because of its hardness and comparative insolubility. The B. P. contains:

	Dose.		*Dose.*
Pulvis Antimonialis	3-6 gr. 2 to 4 decigrms	Pulvis Cretæ Aromaticus	10-60 gr. 6 to 40 decigrms.
Ipecacuanhæ Co.	5-15 gr. 3 to 10 decigrms.	— — — cum Opio	
Opii Co.		— Jalapæ Co.	
Buteæ Seminum	5-20 gr. 3 to 12 decigrms	— Kaladanæ Co.	
Kino Co.		— Rhei Co.	
Scammonii Co.		— Tragacantha	
Catechu Co.	10-60 gr. 6 to 40 decigrms.	— Glycyrrhizæ Co.	60-120 gr. 4 to 8 grms
Cinnamomi Co.			

Pulvis Sodæ Tartaratæ Effervescens (Seidlitz Powder). (*See* Sodium Compounds.) There is no special dose fo. Pulvis Amygdalæ Co.

Spiritus.—Spirits are either simple or complex. Simple Spirits are solutions (which frequently become turbid on the addition of water, owing to the separation of the substance dissolved) in alcohol (90 per cent.) of—

(*a*) A volatile oil:

- Spiritus Anisi
- — Cajuputi
- — Cinnamomi
- — Juniperi
- Spiritus Lavandulæ
- — Menthæ Piperitæ
- — Myristicæ
- — Rosmarini

The strength of all these is 1 in 10, and the dose 5-20m 3 to 12 decimil

(*b*) Of camphor :

Spiritus Camphoræ. *Strength* 1 in 10. *Dose* 5-20m – 3 to 12 decimils.

(*c*) Of chloroform :

Spiritus Chloroformi. *Strength* 1 in 20. *Dose* 5-40m – 3 to 25 decimils.

(*d*) Of ether :

Spiritus Ætheris *Strength* 1 in 3. *Dose* 20-90m. 12 decimils to 6 mils.

Complex Spirits are of varying composition. They are all prepared by distillation. The B. P. contains four, viz. :

	Dose.		*Dose.*
Spiritus Nitrosi Ammoniæ Aromaticus	20-90m 12 decimils to 6 mils.	Spiritus Ammoniæ Fetidus — Armoraciæ Co.	20-90m 12 decimils to 6 mils.

Spiritus Rectificatus is also pharmacopœial.

NOTE.—Sp. is in English a common abbreviation for Spiritus. In French it is the abbreviation for Syrup.

Succi. These are the expressed juices of plants, to which a third of their volume of alcohol (90 per cent.) is added to preserve them. The B. P. contains three :

	Dose.
Succus Scoparii — Taraxaci	1-2 fl. dr. 4 to 8 mils.

Succus Limonis contains no alcohol.

Suppositoria. Suppositories are conical solid bodies containing active drugs for introduction into the rectum or vagina. Each is made to weigh 1 grm. The basis of all is oil of theobroma, except Sup. Glycerini in which it is gelatin.

The B. P. contains seven, viz. Sup. Acidi Carbolici, Acidi Tannici, Belladonnæ, Glycerini, Morphinæ, Iodoformi, and Plumbi Co.

In hot countries if the Suppositories would otherwise be too soft, some of the Oil of Theobroma may be replaced by White Beeswax.

Syrupi.—Syrups are fluid preparations of drug flavoured with sugar.

Examples: Sy. Aurantii, Sy. Rhei. The dose of all is ½ to 1 fl. dr. (2 to 4 mils), except Sy. Cascaræ Aromatica, Sy. Chloral., Sy. Codeinæ Phosphatis, Sy. Rhei, and Sy. Sennæ, of which it is ½ to 2 fl. dr. (2 to 8 mils).

Tabellæ.—Tablets of chocolate, each weighing five grains. The B. P. contains only one:

Tabella Trinitrini (each contains $\frac{1}{130}$ gr. or 0·5 milligramme pure nitro-glycerin). *Dose* 1–2.

Tincturæ. Tinctures are solutions of the active principles of drugs in alcohol. They are closely allied to spirits, from which most of them differ in their mode of preparation. They are prepared by

(*a*) Maceration. The drug is placed in a closed vessel with the whole of the menstruum for seven days, and occasionally shaken. It is then strained. The marc is pressed, and the strained and pressed liquids mixed: *e.g.* Tinct. Opii.

(*b*) Percolation. Moisten the drug with the prescribed quantity of menstruum for four hours, pack in the percolator, add enough menstruum to saturate and leave a layer of liquid above. Macerate for twenty-four hours. Let percolation proceed slowly until the percolate measures three fourths of the finished tincture. The marc is pressed, and the fluid extracted is added to that percolated. After filtration enough menstruum is added to make the prescribed volume of tincture: clarify by subsidence or filtration if necessary; *e.g.* Tinct. Buchu. For the process of repercolation see p. 7.

(*c*) Simple mixing or solution of ingredients: *e.g.* Tinct. Chloroformi et Morphinæ Composita, Tinct. Ferri Perchloridi, Tinct. Quininæ.

Tinctures containing only one active substance are simple. The rest are compound; *e.g.* Tinct. Camphoræ Co.

Some are compound although it is not expressed in their name: they are Tincturæ Catechu, Valerianæ Ammoniata, Valerianæ Indicæ Ammoniata, Guaiaci Ammoniata, and Opii Ammoniata.

It will be observed that, with the exception of four all tinctures given internally have a dose of either 5–15♏ or ½ to 1 fl. dr. Tinct. Iodi Fortis and Tinct. Pyrethri are not used internally.

	Dose.
Tinctura Aconiti	2-5m 12 to 50 centimils
Cantharidini	
Iodi Mitis	
Strophanthi	
Belladonnæ	5-15m 3 to 10 decimil
Cannabis Indicæ	
Capsici	
Chloroformi et Morphinæ Co.	
Cocci	
Colchici	
Daturæ Seminum	
Digitalis	
Ferri Perchloridi	
Gelsemii	
Lobeliæ Ætherea	
Nucis Vomicæ	
Opii	
Podophylli	
—— Indici	
Scillæ	
Stramonii	
Urgineæ	
Alstoniæ	½-1 fl. dr. 2 to 4 mils.
Arnicæ Florum	
Asafetidæ	
Aurantii	
Benzoini Co.	
Berberidis	
Buchu	
Calumbæ	
Camphoræ Co.	
Cardamomi Co.	
Cascarillæ	
Catechu	
Chiratæ	

	Dose.
Tinctura Cinchonæ Co.	½-1 fl. dr. 2 to 4 mils.
Cinnamomi	
Cubebæ	
Ergotæ Ammoniata	
Gentianæ Co.	
Guaiaci Ammoniata	
Hamamelidis	
Hydrastis	
Hyoscyami	
Jalapæ	
Jalapæ Co.	
Kaladanæ	
Kino	
Krameriæ	
Lavandulæ Co.	
Limonis	
Myrrhæ	
Oliveri Corticis	
Opii Ammoniata	
Picrorhizæ	
Pruni Virginianæ	
Quassiæ	
Quillaiæ	
Quininæ	
— Ammoniata	
Rhei Co.	
Senegæ	
Sennæ Co.	
Serpentariæ	
Tolutana	
Valerianæ Ammoniata	
— Indicæ Ammoniata	
Zingiberis	

Several are standardized (*see* p. 8).

Trochisci. Lozenges or Troches are solid preparations for taking by the mouth. They are made either with a fruit basis, a rose basis, a simple basis, or a tolu basis.

Fruit basis. Take 500 times the quantity of the drug ordered for one lozenge. Mix it with 20 grms. of refined sugar and 6·5 grms. of tragacanth. Make the mixture into a paste with sufficient of the black currant paste of commerce to produce 650 grms. Divide into 500 lozenges and dry in hot air chamber; *e.g.* Troch. Acidi Benzoici, Troch. Catechu.

Rose basis.—These lozenges are made in the same way, using the simple basis, except that they are flavoured with oil of rose instead of black currant; *e.g.* Troch. Potassii Chloratis.

Simple basis.—These lozenges are made in the same way except that neither rose water nor black currant is used; the basis is gum acacia; *e.g.* Troch. Ferri Redacti, Troch. Santonini.

Tolu basis.—These lozenges are made in the same way as the simple except that Tincture of Tolu is added; *e.g.* Troch. Morphinæ, Troch. Acidi Tannici.

Troch. Sulphuris has a special mode of preparation.

Unguenta. Ointments are semi-solid preparations consisting of a fatty substance mixed with an active drug. They are spread over the skin, or may be rubbed into it. They are only intended for external use. The basis is either lard, olive oil, wax, spermaceti, paraffin, or hydrous wool fat. Benzoated lard is often used to prevent decomposition. When it is required that the active ingredient should be absorbed, lard, which melts at about the temperature of the body, or hydrous wool fat, is the best basis; when the ointment is required for sores paraffin is a good basis, as it only softens a little at the temperature of the body.

In hot countries if the ointment would otherwise be too soft, the basis may be replaced by benzoated lard, prepared suet, yellow beeswax or white beeswax.

Vina.—Wines are weak tinctures, the drug being extracted with sherry in all except Vinum Ferri Citratis and Vinum Quininæ, in which orange wine is used, and Vinum Aurantii, which is merely a fermented saccharine solution to which orange peel is added.

The dose of Vin. Colchici is 10 to 30m (6 to 18 decimils), of Vin. Quinina ½ to 1 fl. oz. (15 to 30 mils).

With V. Antimoniale and V. Ipecacuanhæ the dose depends upon the purpose for which the drug is used.

The dose of the others is 1 to 4 fl. dr. (4 to 16 mils).

V. Ipecacuanhæ is standardized (*see* p. 8).

The following NON-PHARMACOPŒIAL PREPARATIONS are used :

Abstracta. Powdered extracts double the strength of the crude drug. They are official in the United States Pharmacopœia.

Bougies. Solid cylinders impregnated with various drugs, and used for introduction into the ear (called aurinaria), nose (called buginaria), or urethra. They are made either of gelatin (to be dipped in warm water before use) or oil of theobroma (to be dipped in oil before use). Those for the urethra are made in six sizes, varying from [illegible] to [illegible] inch in diameter.

Cachets, made of wafer paper, consist of two watch-glass shaped halves. The drug is enclosed between them, and they adhere when moistened. The cachet is slightly moistened, put in the back of the mouth, and quickly washed down with a little water. This is an excellent way of giving drugs which are either nauseous or difficult of solution or suspension. Cachets are commonly used for antipyrin ; bismuth salts ; compound ipecacuanha powder ; guaiacol carbonate ; phenacetin ; quinine salts ; aspirin, salol, and other salicylates ; sulphonal, trional, and veronal.

Capsules of gelatin are used in the same way as cachets. They are very useful for nauseous oils.

Cataplasmata.—Soft, pasty external applications made with boiling water having linseed meal as a basis and applied warm (*see* Linseed). An ice poultice consists of crushed ice.

Cerata are ointments containing wax. They are official in the United States Pharmacopœia.

Cigarettes.—The drug replaces the tobacco of an ordinary cigarette.

Collunaria.—Fluids used as nasal douches.

Collyria.—Fluids used as eye washes.

Cremora. Creams are preparations having glycerin, vaseline, or some similar substance as a basis, and used for external application

Elixirs are liquids. All contain alcohol and syrup Most are made with orange peel. Some contain aromatic oils. They are official in the United States Pharmacopœia Some are simply flavouring agents, others contain active ingredients. The British Pharmaceutical Conference has published several, *e.g.* Elixir Cascara Sagrada (same as Syrupus Cascara Sagrada B. P.), Elixir Glusidi, Elixir Guarana, Elixir Phosphori, Elixir Rhei, Elixir Sennæ, Elixir Simplex (same as Syrupus Aromaticus B. P.)

Emulsiones. Mixtures in which the drug exists as an emulsion.

Enemata (enemas or clysters).—Liquid preparations intended for injection into the rectum. When their object is t empty the bowel they are large in bulk (10 to 20 fl. oz.); when it is wished that they should be retained they are usually smaller in bulk. After injection a towel may be pressed against the anus. Mucilage made with starch (*see* Starch) is a good basis

Essentiæ (essences).—Solutions of volatile oils in rectified spirit, usually of a strength of 1 in 5.

Fomenta. Fomentations consist of flannels wrung out in hot water, to which drugs may or may not have been added.

Gargarisma. A fluid preparation used for gargling.

Granules are small pills.

Guttæ. Fluid preparations to be dropped into the eye.

Haustus.—A draught. This term is used when only a single dose of a fluid preparation is required.

Insufflationes. Powders for blowing into the throat and larynx.

Lanolinum. An ointment with hydrous wool fat as a basis.

Linctus.—This has honey, treacle, or some other thick substance as a basis. It is to be swallowed slowly, being retained some time in the mouth.

Massæ consist of substances mixed so as to be of a consistency suitable for making pills. They are official in the United States Pharmacopœia.

Mollinum.—A mollinum is an ointment having for its basis mollin, a superfatted soap. It is readily absorbed, and also readily washed off with water.

Nebulæ.—Solutions sprayed into the throat by means of an atomizer.

Paste.—A preparation to be applied as an ointment.

Pastillus.—Pastils are lozenges having glyco-gelatin as a basis.

Perles are small gelatin capsules.

Pessus. Pessaries are solid preparations made like suppositories, and introduced into the vagina.

Pigmentum. A paint is a preparation adapted for painting on the skin, throat, &c.

Tablets. Solid, disc-like or lenticular bodies made by compression. They are very popular, but are often useless, for they may be so hard and insoluble that they are found in the fæces quite unaltered.

Triturationes are intimate mixtures of substances with sugar of milk. They are official in the United States Pharmacopœia.

Vapores. Inhalations are preparations arranged for the inhalation of volatile drugs.

Vaselinum. This term is applied to an ointment the basis of which is vaseline.

PHARMACOLOGY AND THERAPEUTICS.

Before describing the actions and uses of drugs we must consider the manner, quantity, and form in which to give them.

MODES OF ADMINISTRATION OF DRUGS.

(*a*) **Into the blood-vessels** by injection. This method is rarely used in man, except that a saline solution (rather more than a tea-spoonful of common salt to the pint of sterilized water at the temperature of the body) is injected into a vein in cases of great collapse, and salvarsan for syphilis.

(*b*) **Into the subcutaneous tissues** by hypodermic injection. The skin of the patient, where it is lax, should be raised between the thumb and forefinger of the operator's left hand; the skin of the forearm is often selected. In his right hand he takes a perfectly clean syringe containing the quantity of fluid to be injected, and fitted with an aseptic hollow silver needle, which is thrust under the raised piece of skin, but not into the muscles, for about an inch, care being taken to avoid wounding a vein. The syringe is slowly emptied, then withdrawn, and the thumb pressed lightly upon the seat of injection for a few seconds. The advantage of this method is that the drug is surely and quickly absorbed. The fluid used must not contain solid particles, nor be irritating, or abscesses will result; it must be aseptic, and therefore if it is not freshly prepared it may contain a little carbolic acid—or, better still, boracic acid, for this is non-poisonous and non-irritating. The bulk injected should, if possible, be about five minims. For injections that are not in constant use it is advisable to keep the drugs in the form of lamellæ, and to dissolve one in a few minims of water as required. Mercurials are occasionally injected directly into muscles (*see* Mercury).

(*c*) **Into serous cavities** by injection. This method is rarely used in man except when the object is to wash out, with saline solution, a serous cavity, as the pleura, which has been opened, or to produce adhesive inflammation, as in the injection of irritants into the tunica vaginalis.

(*d*) **Into mucous cavities.** - Drugs are most frequently given by the **mouth,** to be absorbed from the mucous membrane of the stomach or intestines, but the rate of absorption is much slower than from the subcutaneous tissue, and will depend upon whether the drug is readily soluble in the gastro-intestinal secretions, and whether it is given on an empty stomach, in which case it will be quickly absorbed; or on a full one, when it will be slowly absorbed. Some drugs, given by the mouth and absorbed from the stomach or intestines, probably never reach the general circulation, as they are excreted in the bile by the liver. The drug should be in a pleasant palatable form, and, generally, so combined as not to irritate.

Drugs are sometimes given by the **rectum**—in a solid form as **suppositories,** in a liquid form as **enemata** or clysters; but they are neither dissolved nor absorbed here so quickly as in the upper part of the gastro-intestinal canal.

For local effects they may be given by the **urethra** or **vagina (injections, bougies, pessaries),** or by the **respiratory passages (inhalations, cigarettes, sprays,** or **nebulæ** for **inhaling)**; **insufflations** for blowing into the throat and larynx; **pigmenta, gargles, lozenges,** for a local effect on the mouth and pharynx; **nasal douches** for the nose. For sprays an atomizer is required. Sometimes volatile drugs, as chloroform or amyl nitrite, are inhaled for their general effect.

(*e*) **By the skin.** Some drugs may be absorbed from the skin if mixed with some fatty substance. In this way mercury may be absorbed by being rubbed in; but drugs are chiefly applied to the skin as ointments, plasters, &c., for their local effect.

Cataphoresis is a means of introducing drugs through the skin. A large pad soaked in a solution of the drug forms the positive pole of a galvanic battery. It is placed on the skin over the part, *e.g.* knee, to be influenced, and the negative pole is placed on the skin near by. When the current flows he drug passes through the skin. Potassium iodide, soluble mercurials, salicylates, and other drugs are applied this way.

Drugs are also applied to the **eye** and **ear** as drops and washes.

DOSES.

The study of doses is termed **Posology**. In determining the dose the following considerations have to be borne in mind:

1. Age.—The adult dose is that for a person between twenty and sixty years old.

A common rule is, for **children** under twelve, to add twelve to the age, and divide the age by the number thus obtained. Thus for a child aged eight the dose will be $\frac{8}{8+12}$ of an adult dose. From twelve to sixteen years from ½ to ¾ of the adult dose is required, and from seventeen to twenty years from ¾ to ⅘. Dryer and Walker give the following:

At 21 years . .	full dose	At 3–4 years . .	⅓ dose
„ 15 „ . .	¾ „	„ 1 year . .	¼ „
„ 9–10 „ . .	½ „	Early months .	$\frac{1}{15}$ „

There are exceptions to these rules for individual drugs; *e.g.* children take iron, cod liver oil, arsenic, and chloral very well, but they can take only very small doses of opium.

Above sixty years of age the dose should slightly diminish as age increases.

2. Weight.—In pharmacological experiments the dose should always be expressed as a proportion of the weight of the animal. In man the weight is not often considered, for it depends so much upon bone and fat, which are not active tissues; but, as a rule, women require rather a smaller dose of medicine than men.

3. Habit.—A man who is constantly under the action of a drug becomes very insusceptible to it. Thus an opium eater requires enormous doses of opium to produce any effect. A person who habitually takes purgatives requires very strong ones to open the bowels.

4. Idiosyncrasy.—The susceptibility to drugs varies very much. Some persons are salivated by minute doses of mercury, others bear it very well, and there is hardly a drug to which some people are not either exceptionally indifferent or susceptible.

5. Time of Administration.—Drugs affect to greatest advantage when given so that their effect will be produced at its natural time. Thus soporifics act best when given in the evening, slowly acting purgatives when given overnight, quickly acting ones when given before breakfast, ergot when given during labour.

6. Mode of Administration. We have seen that drugs are rapidly absorbed from the subcutaneous tissues. Therefore a smaller dose is required for subcutaneous injection than when the same drug is given by the mouth, for absorption is slow from the upper gastro-intestinal tract. It is usually slower still from the rectum, but there are many individual differences with different drugs; thus strychnine is not absorbed from the stomach, but is readily taken up from the pharynx and rectum, but prussic acid is readily absorbed from the stomach. Also certain drugs are excreted by the liver or destroyed in it when given by the stomach. Other things being equal, absorption takes place quickly with an empty, slowly with a full, viscus.

7. Mental Emotion. Sometimes if the patient's mind is particularly fixed on the action of the drug a small dose is powerful. For example, often, if the patient is convinced he will sleep, a very small dose of morphine is all that may be required.

8. Temperature.—As the action of the drug on the organism is often partly chemical, the temperature must, in cold blooded animals and excised structures, as muscle, &c., help to determine its action; but the temperature of man varies within so few degrees that this is not an important factor in medicine.

9. Preparation of Drug. A smaller dose of a soluble preparation, as a tincture, will be required than of a solid preparation, as a pill, which will have to be slowly dissolved before absorption.

10. Rate of Excretion. It is obvious that, other things being equal, a smaller dose will be required of a drug that is slowly excreted than of one which is rapidly excreted

11. Cumulative Action. Sometimes it is found that if a person has been taking a drug regularly, but without the production of any toxic symptoms, these will suddenly develope. This is said to be due to the cumulative action of the drug. It may be caused by the following circumstances:

(*a*) The drug may be absorbed more rapidly than it is excreted. This is the cause of the cumulative action of mercury and lead, both of which are excreted with difficulty by the kidney.

(*b*) There may be a sudden arrest in the excretion of the drug. It has been suggested that digitalis and strychnine, when the quantity of them in the tissues reaches a certain amount, contract the renal vessels, and hence excretion is arrested.

(*c*) It is possible that, owing to an alteration in the intestinal contents, a drug which was previously very slowly dissolved becomes quickly dissolved, and hence rapidly absorbed.

12. Disease.—The physiological action of drugs, and consequently the dose, are profoundly modified by disease. For example, a patient with peritonitis will bear enormous doses of opium. Antipyretics, which do not affect a normal temperature, powerfully depress a febrile temperature.

13. Species.—Different animals are often able to withstand largely different doses. Thus birds are very tolerant to opium, herbivora to atropine, and hedgehogs to many poisons, e.g. cantharides, and white rats are much more tolerant than brown to various toxins. This probably depends upon the different chemical composition of the tissues of various animals.

PRESCRIBING.

The more complex **prescriptions** consist of

(1) The Basis, or principal active ingredient.
(2) The Adjuvans, or that which assists its action.
(3) The Corrigens, or that which corrects its operation.
(4) The Constituens, vehicle, or excipient, which imparts an agreeable form.

Thus the object of every prescription is, if possible, to cure quickly, safely, and pleasantly. For example, in Pilula Colocynthidis et Hyoscyami the colocynth is the basis, the aloes and scammony form the adjuvans, and the extract of hyoscyamus is the corrigens to prevent the griping. In Mistura Cretæ the cinnamon water is the vehicle. Many drugs do not require anything to assist their action or correct their operation.

Incompatibility of ingredients should be particularly avoided in prescriptions. There are three kinds of incompatibility :

(a) Chemical Incompatibility. Usually when chemical incompatibility occurs in a prescription, it is due to interaction between two soluble salts leading to the formation of another salt. Sometimes chemical incompatibility is encountered designedly, for example, perchloride of mercury is often prescribed with potassium iodide, mercuric biniodide is formed, but is kept in solution by the excess of potassium iodide. Often, however, in careless prescriptions, the interaction of soluble salts leads to the formation of a salt which is insoluble in the mixture, and a precipitate falls to the bottom of the bottle. It is important to remember that **glucosides** should not be ordered with free acids, which decompose them ; nor **alkaloids** or **alkaloidal salts** with

alkalies, alkaline salts, tannic acid, iodides, or bromides, for they precipitate them. Failure to remember this has caused death, all the alkaloid being swallowed in the last dose in the bottle.

With the following drugs it is **particularly difficult to avoid chemical incompatibility**:

Antipyrin.
Chlorine in solution.
Iodine in solution.
Liquid preparations of Iron.
Lead salts.
Zinc salts.
Silver salts.
Mercuric Chloride (especially).
All Iodides.
All Bromides.
Potassium Permanganate.
Potassium Acetate.
Nitrites.
Tannic Acid.
Gallic Acid.
Acidum Hydrocyanicum Dilutum.
Mineral Acids.
Liquor Potassæ.
Quinine Sulphate.
Guaiacum Tincture.

Substances rich in oxygen, as chlorates, iodates, permanganates, picrates, nitrates, and bichromates, should **not** be mixed **with readily oxidizable substances,** such as charcoal, sulphur, iodine, carbolic acid, glycerin, turpentine, and organic compounds generally, for explosive compounds are very liable to be formed.

Poisonous compounds may be formed by the admixture of substances in solution; *e.g.* potassium chlorate and the syrup of iodide of iron liberate iodine, dilute hydrocyanic acid and calomel form cyanide of mercury, potassium chlorate and potassium iodide form at the temperature of the body a poisonous compound, probably potassium iodate. Death has occurred owing to patients having taken some of these careless prescriptions.

If, in a mixture, incompatibles are inevitable, they should both be diluted with the vehicle before they are added to each other. The careful prescriber will avoid combining any of the above incompatible substances.

(*b*) *Physical Incompatibility.*—This occurs when the mixture of the substances will not form a clear solution; *e.g.* insoluble powders and oils will not mix with water, the addition of which to some spirits and all resinous tinctures, and to liquid extract of male fern, causes a precipitate; an acid mixture is flavoured with liquorice, but the acid precipitates glycyrrhizin; an alcoholic solution added to chloral causes all the chloral to rise to the top.

In such cases the solution may be **thickened** so that the precipitate is suspended in it **to form a suspension or an** *[illegible] precipitate each other. P means "forms a precipitate."*

	Alkaloidal solutions.	Metallic solutions (general).	Lead or silver solutions.	Calcic solutions.	Magnesic solutions.	Albuminous or gelatinous solutions.
Solutions of alkalies	P	P	P	P	P	
Tannic acid	P	P	P	—	—	P
Carbonic acid and solutions of carbonates	P	P	P	P	P	
Sulphuric acid and solutions of sulphates	—	—	P	P		
Phosphoric acid and solutions of phosphates	P	P	P	P	P	
Boric acid and solutions of borates	P	P	P			
Hydrochloric acid and solutions of chlorides	—	—	P			
Hydrobromic acid and solutions of bromides	—	—	P			
Hydriodic acid and solutions of iodides	P	—	P			
Solutions of sulphides		P	P			
Arsenical solutions	—	P	P			
Albumen	—	P	P			

Examples of chemical incompatibility are the prescribing of (1) tannic acid or substances containing it with alkaloids or metallic salts, especially those of iron; (2) vinegars or syrups containing acetic acid prescribed with carbonates lead to the evolution of CO_2; (3) strychnine sulphate is decomposed by potassium bromide, and strychnine is precipitated; (4) chloral and alkalies form chloroform; (5) quinine sulphate and potassium acetate together cause a voluminous precipitate of quinine acetate; (6) lime water with mercury salts (this incompatibility is intentional in Lotio Nigra and Lotio Flava) precipitates oxides of mercury; it decomposes carbonates and bicarbonates of alkalies; it precipitates solutions of quinine and morphine salts; (7) mercuric chloride is incompatible with most substances.

emulsion, but even then the mixture must be shaken before a dose is taken. **Mucilage of acacia** is the best suspending agent. The substances incompatible with it are mentioned on p. 6. **Tragacanth** is often preferred, for it keeps better than acacia ; the addition of a little almond oil improves the appearance of the mixture. It is used, for example, to suspend the guaiac resin in Mistura Guaiaci. **Indian Gum** resembles acacia.

1 pt. of most fixed oils requires	M. Acaciæ	¾ pt.,	water	1 pt.
1 pt. of balsam of Peru	,,	2	,,	1½
1 pt. of oil of turpentine	,,	1	,,	1

Sometimes yolk of egg or milk is employed to form an emulsion or suspension. **Liquor Potassæ** much facilitates the admixture of fixed oils and water. This, for example, is the object of the Liquor Potassæ in Mistura Olei Ricini of B. P. 1885. It often, however, acts chemically on the ingredients of the prescription. Tincture of quillaia and tincture of senega, as they contain saponin (*q.v.*), aid the emulsification of any oil. Light carbonate of magnesium is employed to aid the diffusion of an oil in water, as in Vapor Olei Pini Sylvestris of B. P. 1885. Resinous tinctures require an emulsifying agent; an equal part of mucilage of acacia is the best. The suspension of oil of turpentine in mucilage of acacia is a common non-official example of an emulsion.

(*c*) *Pharmacological Incompatibility*; *e.g.* the combination of purgatives with astringents. Sometimes this is intentional, as in the occasional addition of atropine to a hypodermic solution of morphine. After the description of each drug, those that are incompatible with it will be enumerated.

THE PRESCRIPTION.

The details of a prescription should be written in the following order:

The *first* part is the *Superscription*, which is the sign ℞, an abbreviation for Recipe, "Take."

The *second* part is the *Inscription*, consisting of the names of the drugs in the genitive case (the vehicle in the accusative if "ad" is used with it), and their doses in the accusative.

The *third* part is the *Subscription*, that is to say, the directions to the dispenser. This in England and most other countries is sometimes written in Latin, but in France and the United States it is always in the native language.

The *fourth* part is the *Signature*, that is to say, the directions to the patient (from L. "Signetur," let it be labelled). This is written in English.

The *fifth* part consists of the doctor's name or initials at the bottom on the right, the patient's name at the bottom on the left, and under it the date; thus:

Superscription.—℞
Inscription.—Tincturæ Ferri Perchloridi fl. dr iij (basis).
Quininæ Hydrochloridi gr. xxx (adjuvans).
Magnesii Sulphatis oz. ij (corrigens),
Glycerini, fl. oz. ij (corrigens).
Infusum Quassiæ ad fl. oz. viij (excipient).
Subscription.—Fiat mistura.
Signature. Take one tablespoonful three times a day, two hours after meals. A. B. C. (doctor's initials).
William Smith, Esq. (patient's name).
16th June, 1914 (date).

Abbreviations.—Often this prescription would be abbreviated thus:

℞ Tr. Ferr. Perchlor. fl. dr. iij.
Quin. Hydrochl. gr. xxx.
Mag. Sulph., oz. ij.
Glycer., fl. oz. ij.
Inf. Quass. ad fl. oz. viij.
F. m.

Take one tablespoonful thrice a day, two hours after meals.
William Smith, Esq. A. B. C.
16th June, 1914.

ss, and *fs* are abbreviations for semi, a half, and āā for ana, of each.

The following is a prescription for a pill

℞ Extracti Nucis Vomicæ gr. ¼.
Extracti Euonymi } āā gr. *fs*.
Aloini }
Hydrargyri Subchloridi gr. j.
Extractum Hyoscyami ad gr. v.
Fiat pilula. Mitte 24.
Take one immediately before dinner every evening.
William Smith, Esq. A. B. C.
11th Nov., 1914.

It will be observed that the quantities in the prescription are for one pill only, and the chemist is directed to send 24. Often, however, the prescription is written with the quantity of each ingredient necessary to make the full number of pills.

Thus:

℞ Extracti Nucis Vomicæ gr. vj.
Extracti Euonymi } āā gr. xij.
Aloini }
Hydrargyri Subchloridi gr. xxiv.
Extractum Hyoscyami ad gr. cxx.
Fiant pilulæ 24.
Take one immediately before dinner every evening.
William Smith, Esq. A. B. C.
11th Nov., 1914.

Prescriptions for powders are also written in either way.

The following is a metric prescription such as would be used on the Continent. The quantities, either of fluids or solids, are expressed in grammes, so that the abbreviation gm. for this word is omitted.

℞	Magnesiæ Sulphatis . . .	30
	Acidi Sulphurici Diluti . . .	0·6
	Syrupi Limonis	30
	Aquæ	180

Fiat haustus.
To be taken on rising in the morning.
William Smith, Esq. A. B. C.
22 Jan., 1914.

The medicine may be prescribed as a **pill** when it is required that the patient shall carry it about with him, when only a small dose is needed, when it is desirable that it shall act slowly, when it is required to act on the lower bowel, when it is insoluble or nauseous, or when it is difficult to prescribe in the liquid form. Kaolin is the best basis for substances, as permanganate of potassium, which are decomposed by contact with organic matter.

Oils, and volatile, deliquescent, or bulky substances should not be prescribed as pills, as they require much solid excipient; nor should pills be used for substances required to act immediately. Insoluble or very nasty powders are often best given in *cachets*.

If it is required to give the drug in an *effervescing* draught or mixture, an alkaline carbonate is prescribed with the mixture containing the drug, while a solution of citric acid (*q.v.*) or tartaric acid (*q.v.*) is prescribed in a separate bottle. A dose from one bottle is mixed with a dose from the other, the acid acting on the carbonate liberates carbonic acid gas, hence the mixture effervesces. It should be drunk before effervescence has passed off.

Abbreviations should be employed as little as possible. The edition of the "British Pharmacopœia" published 1914 is the first giving an official abbreviation for each official substance and preparation in the "Pharmacopœia." Serious mistakes have happened because the abbreviations have been ambiguous. The following are especially to be avoided:

Acid. Hydroc.	(may be either	Acidum Hydrochloricum or Acidum Hydrocyanicum).
Ext. Col.	(,, ,,	Extractum Colchici or Extractum Colocynthidis).
Hyd. Chlor.	(,, ,,	Calomel, Corrosive sublimate, or Chloral hydrate).
Hyd.	(,, ,,	Hydrargyrum, Hydras, Hydriodas, Hydrochloras, Hydrochloridum, or Hydrocyanicus).
Sulph.	(,, ,,	Sulphur, Sulphide, Sulphate, or Sulphite).

Sometimes the signature is written in Latin, and it is often abbreviated. A list of such abbreviations is given in the Appendix.

In Great Britain it is always understood, unless otherwise stated, that the preparations are those of the British Pharmacopœia.

Ad. The prescriber should be careful in deciding whether or not to use this word before the vehicle. If it had been left out in the prescription on p. 39, the bulk of the mixture would have been nearly 10½ fluid ounces, and the amount of the ingredients in each dose would have been less than was intended.

Dispensing the Prescription. The dispenser should bear the following rules in mind: (1) Read the prescription through first. (2) Next write the directions, so that they have time to dry. (3) Solution by heat should not be used if more of the salt is ordered than will dissolve in cold water. In such a case it must be suspended. (4) With fluids, measure them in such an order that the measure-glass shall be finally rinsed out with the vehicle. (5) Use glass scale pans. (6) Clean and put away everything directly after use. (7) If in the slightest doubt ask the prescriber. (8) If finally the prescription contains any insoluble matter, label "Shake the bottle." (9) If the medicine is very poisonous, label it as such and use a distinctive bottle. (10) If for outward application only, say so. (11) In dispensing substances chemically incompatible, if there is any likelihood that the new body formed is dangerous, communicate with the prescriber before dispensing (*e.g.* potassium iodide prescribed with Spiritus Ætheris Nitrosi forms free iodine; alkaloids are precipitated by alkalies). Should there be no such reason against dispensing the prescription, keep the incompatibles as far apart as possible by diluting each with the vehicle before mixing.

PHARMACOLOGICAL AND THERAPEUTICAL ACTIONS.

When the action of a drug is spoken of, the physiological action is usually understood.

The primary action is that due to the unaltered drug; *e.g.* the emetic action of sulphate of zinc.

The secondary action is that due to compounds formed from the drug whilst it is in the body; *e.g.* the antiseptic effect on the urine of Uva Ursi taken by the mouth is by some thought to be due to the fact that arbutin, the active principle of Uva Ursi, is in its passage through the kidney decomposed into a glucoside and hydroquinone, and the latter is a powerful antiseptic.

The direct or local action of a drug is that produced on any organ with which it comes in contact; *e.g.* the cantharidin in cantharides, in being excreted through the kidneys, causes inflammation of them.

The indirect or remote action is a secondary effect, the result of the direct effect; *e.g.* curare paralyses the respiratory muscles, consequently the blood becomes venous, and therefore convulsions take place. In this case the venosity of the blood and the convulsions are each of them indirect actions of curare.

It is clear that, among drugs acting on the same parts, the total effect will depend very much upon which part is first affected. For example, atropine and curare will paralyse motor nerves, but atropine first affects the terminations of the vagus, and only late in its action the motor nerves of the voluntary and respiratory muscles; hence paralysis and asphyxia are late symptoms, and a rapid pulse is an early symptom. Curare, however, early affects the nerve-endings of the voluntary and respiratory muscles, and the heart towards the end; therefore asphyxia and paralysis occur early, and a rapid pulse is a late symptom.

Relation between Chemical Constitution and Physiological Action. There is no doubt that the physiological action of a drug often depends upon its chemical constitution. Naturally, substances which are broken up in the body in such a way as to lead to the liberation of a common element or group will have a similar action. The action of a drug also depends upon electrolytic dissociation of its solutions, and then the effect depends upon which ion is the more poisonous. For example, the hydrochloride and sulphate of strychnine will have the same action owing to the intensity of action of the strychnine ion, and because the chlorine and sulphate ions can be disregarded, for the animal would be killed by the strychnine ion before enough of the chloride or sulphate ions could be given to have any influence. But with sodium chloride and sodium sulphate the action is quite different, because, the sodium being almost harmless, sufficient quantity of the drugs can be given for the chlorine and sulphate ions to have their separate effects.

Instances in which chemical constitution obviously influences action are the similarity of effects of nitrites, the fact that all chlorides, bromides, and iodides of ethane and methane are anæsthetic, the similarity of action of iodides of many metals and the similarity of action of bromides of many metals.

Substitution of one radical for another in organic compounds often strikingly modifies their action; for example, if strychnine, brucine, and thebaine are converted into methylstrychnine, methylbrucine, and methylthebaine, the convulsive action of each of the first three substances is replaced by a paralysing action. The effect of substitution may be also well seen in the various derivatives of atropine and cocaine, and in the relation of aconitine (*q.v.*) to benzaconine and aconine. Another very interesting case in point is that methyl glucoside is sweet, ethyl glucoside is somewhat sweet, phenyl glucoside is bitter, and benzyl glucoside is intensely bitter.

Sometimes the position of the radicals in the molecule is of great physiological importance: thus resorcin (metadihydroxybenzene) is very sweet, whilst pyrocatechin (orthodihydroxybenzene) is bitter.

Sometimes the molecular weight appears to influence the intensity of action, for the relative toxicity of various alcohols is as follows: methyl alcohol, 0·8; ethyl alcohol, 1·0; propyl alcohol, 2·0; butyl alcohol, 3·0; amyl alcohol, 4·0.

The difficulty of the whole subject is, however, so great that it is impossible at present to lay down any laws sufficiently general to be of any use to the beginner. It must be remembered that dissimilarity of action is often more apparent than real, for it may be due to varying solubility, digestibility, rate of absorption, rate of elimination, or rate of diffusion, also to the organ which happens to be first affected, and the degree to which the drug can dissolve the constituents of tissues.*

Relation between Physical Condition and Physiological Action. The physical condition must obviously influence the action. For example, a volatile drug can act directly on the respiratory mucous membrane, and it can be absorbed very rapidly. Drugs insoluble in the gastro-intestinal fluids act very slowly unless given in solution. Again, the rate and direction of diffusion must depend upon whether the solution of the drug is isotonic, hypotonic, or hypertonic as regards the fluid with which its solution is diffusing. But often the action of physical laws is apparently interfered with by selective action of cells, in which case the drug must enter into chemical combination with the affected cells. Sometimes this selective action is very striking; for example, alcohol and lead both produce peripheral neuritis, but alcohol chiefly affects the anterior tibial nerve, whilst lead affects the musculo-spiral. Inasmuch as the results of diffusion are best seen with solutions of salts of alkaline metals, effects on the body which result from diffusion are said to be due to "*salt action.*"

Drugs may be classified according to the parts on which they act, and before describing each individual drug a classification on this principle will be given.

Division I. Drugs acting upon Organisms which infest the Human Body, or upon Processes going on outside it.

Antiseptics are drugs which arrest putrefaction, either by preventing the growth of, or completely destroying, the micro-organisms on which decomposition depends. Some authors limit the use of the word to those drugs which prevent the growth of micro-organisms, and call those substances which destroy the micro-organisms **disinfectants.**

Statements are most discordant as to whether certain substances are antiseptics, and as to the strength of their antiseptic power. This is because antiseptics act differently on different organisms; and the distinction has not been drawn between preventing the growth of and destroying micro-organisms. Also because the power of antiseptics depends upon the temperature at which they act, the medium in which they are dissolved, the strength of the solution, the time given them to act, and the number of micro-organisms present in the substance to which they are added.

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* Those wishing for further information on this subject should consult *The Chemical Basis of Pharmacology*, by Francis and Fortescue-Brickdale. Arnold. 1908.

To properly test the value of an antiseptic the above conditions must be noted. All instruments and substances except the fluid containing the micro-organisms to be tested are heated so that any adventitious micro-organisms are destroyed. A cultivating medium, such as agar-agar jelly, in which the micro-organisms will grow, is selected, and two test-tubes, each containing some of it, are taken; to one of these the supposed antiseptic is added. Some fluid containing the micro-organisms is then added to both test-tubes; both are plugged with sterilized cotton wool to prevent the entrance of germs from the air, and it is observed whether the micro-organisms will grow in the tube containing no antiseptic, but not in that containing the antiseptic. As the power of an antiseptic depends on so many circumstances, no exact order of their potency can be given, but roughly the more powerful are placed first in the following list:

1. **Heat.** -This is the best antiseptic, but a temperature of at least 100° C. is usually required. After an infectious fever, clothing, bedding, &c., may be heated in a dry air chamber to between 100° and 150 C.; or what is far better, as dry air does not penetrate the spores nearly as well as moist, and the interior of the rolls of fabrics often hardly gets heated at all, steam under pressure may be driven through them. Another useful way is to boil the infected things in water. Surgical instruments are disinfected in this way.

2. **Perchloride of Mercury.**—A solution of 1 in 1000 is

constantly used for washing hands, and many other purposes connected with midwifery and surgical operations.

3. **Chlorine** is, as a rule, too irritating. Chlorine gas, disengaged by the action of hydrochloric acid on black oxide of manganese, may be used to disinfect a room, the windows, chimneys, and doors of which are pasted up. Disengaged from chlorinated lime, it is used to disinfect and deodorize urinals. It must be remembered that it attacks and bleaches many substances.

4. **Bromine,** and 5. **Iodine vapours** are rarely used, as they are too irritating, but tincture of iodine is frequently painted on the skin to disinfect it before operations.

6. **Iodoform** yields iodine when in contact with animal tissues and so acts as an antiseptic.

7. **Carbolic acid** is largely used.

8. **Cresol** and its allies are very powerful and much used.

9. **Creosote**, 10. **Thymol**, and 11. **Naphthol** are as powerful as carbolic acid, but far less soluble in water.

12. **Salicylic acid,** 13. **Resorcin,** 14. **Quinine,** 15. **Oleum Eucalypti** and other essential oils and oleo resins.

16. **Balsam of Tolu**, 17. **Balsam of Peru**, 18. **Benzoin** are powerful but too expensive for general use.

19. **Peroxide of hydrogen** is used in surgery. It is also the active ingredient of Sanitas.

20. **Sulphur dioxide**, formed by burning sulphur, is used to disinfect rooms.

21. **Boric acid** is feeble, but, as it is not irritating, it is widely used for surgical purposes and for preserving food materials.

22. **Permanganate of potassium,** and 23. **Chloride of zinc** are used domestically.

24. **Sulphate of zinc,** 25. **Sulphate of copper,** 26. **Nitrate of silver,** 27. **Potassium bichromate.**

28. Strong acids and alkalies such as **hydrochloric acid and caustic potash.**

29. **Alcohol** is antiseptic only in strong solution.

Dixon gives the following useful classification of the way in which antiseptics act:—

(*a*) Salt action. These by osmosis extract water from micro-organisms and so kill them, *e.g.* common salt (used for preserving meat) and sugar (for preserving fruit).

(*b*) Oxidation, *e.g.* potassium permanganate. Chlorine, bromine, and iodine act in the presence of water by abstracting hydrogen.

(c) **Reduction**, *e.g.* sulphur dioxide in the presence of water, and formic aldehyde, which, however, also combines with proteins.

(d) **Precipitation of proteins**, *e.g.* many metals by acting directly on the micro-organisms and also on their food in solution.

(e) **Protoplasmic poisons**, *e.g.* coal-tar products.

We do not know of any drugs which, when taken internally or inhaled, will certainly destroy micro-organisms, either in the gastro-intestinal tract or respiratory passages, unless they are sufficiently concentrated to be fatal to the patient. Some authorities, however, consider that naphthol, calomel, cyllin, and certain other substances will destroy micro-organisms in the stomach and intestines, cyllin being the most active. As the ethereal sulphates in the urine are increased by bacterial action in the intestine, they form a gauge of the efficacy of intestinal antiseptics, and it is said they are a little decreased in some diseases after giving these drugs. Many attempts have been made to combat diseases due to micro-organisms by the injection of antiseptics into the blood, but there is no evidence of any success.

Deodorants or deodorizers are substances which destroy disagreeable smells. There are too many for enumeration. Many antiseptics are deodorizers

Antizymotics.—This is a word sometimes applied to drugs which arrest fermentation.

Anthelmintics are drugs which kill such parasitic worms as infest the alimentary canal. Three kinds only are commonly met with among people living in England.

(1) Tapeworm (*Tænia solium* and *T. mediocanellata*). Anthelmintics: **Filix Mas** (mostly used). **Oleum Terebinthinæ, Cusso, Pelletierine, Melon Pumpkin Seeds, Embelia.**

(2) Roundworm (*Ascaris lumbricoides*). **Santonin** (probably more strictly a vermifuge). **Neem Bark, Butea Seeds.**

(3) Threadworm (*Oxyuris vermicularis*). Anthelmintics:

Rectal injections of **salt water, infusion of quassia, solutions of iron salts,** or **diluted oil of turpentine.** It is doubtful whether these drugs (except turpentine) relieve the patient by killing the threadworms which inhabit the rectum, or merely render this part unfit for them by removal of mucus.

Anthelmintics for the tape- or round-worm should be given when the alimentary tract is empty. Hence it is a good plan to give a dose of castor oil a few hours before the anthelmintic, so as to ensure that the drug comes in contact with the worm. To expel the dead parasite a purgative should be given a few hours after the anthelmintic. Purgatives used for this purpose are called **Vermifuges. Vermicide** is a term sometimes applied to drugs which kill intestinal entozoa.

Antiparasitics or parasiticides are substances which destroy parasites. The term is usually applied to those which destroy parasites infesting the skin.

(1) For the various forms of tinea the following are used: **Mercurial** preparations, especially the oleate, tincture of **iodine,** glycerin of **carbolic acid,** an ointment of **pyrogallic acid,** a **boric acid** lotion, **salicylic acid** lotion, **acidum sulphurosum, formalin,** and **thymol**; and if the patches are small, severe irritants, as **croton oil, cantharides,** and **chrysarobin** ointment. *T. versicolor* never requires severe irritants.

(2) As a parasiticide for itch, **sulphur** ointment is generally used. **Balsam of Peru** and **Storax** are also effectual.

(3) Pediculi vestimentorum will be killed by any mild parasiticide. Unguentum **Staphisagriæ** is often used.

(4) Pediculi capitis and pediculi pubis are also easily killed by mild parasiticides; **mercurials** are commonly employed, so is Unguentum **Staphisagriæ.**

Antiperiodics are drugs which arrest the return of diseases which recur periodically. Some, and probably all, act as direct poisons to the micro-organism causing the disease.

They are **cinchona bark, quinine** and its salts (by far the most powerful), **cinchonine, arsenious acid, eucalyptus, hydrastis, salicin,** and **salicylic acid.** They are used for all forms of intermittent fever and neuralgia.

Division II.—Drugs acting on the Blood.

A. Drugs acting on the Plasma. Many substances must after absorption exist in solution in the plasma, and purgatives, diuretics, and diaphoretics must alter the composition of the plasma by abstracting substances from it. Only very slight changes in the reaction of plasma, which is normally practically neutral, are compatible with life. It is never necessary to make the plasma more acid, as any excess of alkali is neutralised by carbonic acid, but in certain conditions there may be an excess of acid, which requires neutralisation. This is done by means of the carbonates, citrates, or tartrates of the following metals:—

(1) **Potassium.**
(2) **Sodium.**
(3) **Ammonium.**
(4) **Lithium.**
(5) **Magnesium.**
(6) **Calcium.**

The citrates and tartrates of these metals are oxidised in the body to alkaline carbonates.

Therapeutics. Alkalies are administered to reduce the acidosis of diabetic coma, sodium bicarbonate being the drug usually selected. They are also given in gout in the hope of increasing the solubility of uric acid in the plasma. As the treatment is continued for some time, a preparation which does not upset digestion, such as potassium citrate or lithium citrate, is usually preferred. Both potassium and lithium urates are more soluble than the sodium urate, but the change produced in the composition of the plasma must be very slight. The excretion of potassium and lithium carbonates in the urine, which results, aids the excretion of uric acid by increasing its solubility in the urine and by causing diuresis. For the same purpose natural alkaline waters are frequently prescribed.

In *lead-poisoning* the lead is locked up in the tissues in a very sparingly soluble form. Potassium iodide is given because some authorities believe it increases the solubility of lead in the plasma, and consequently facilitates its excretion by the kidneys.

Alkalies have been largely used in *rheumatic fever*, on the assumption that there is a deleterious agent in the plasma, and that its solubility is increased by increasing the alkalinity of the plasma; but this treatment has now been abandoned in favour of that by salicylates. For the same theoretical reason alkalies have been given in rheumatoid arthritis.

Purgatives, *diaphoretics*, and *diuretics* necessarily alter the composition of the plasma, and are largely used when there is much œdema of any part, or effusion into serous cavities, in the hope that as fast as these remedies drain off fluid from the plasma it will be replaced by that which is effused pathologically. Also they are given in conditions, as uræmia, in which it is thought that there are poisons in the blood, in order that their excretion may be hastened.

The composition of the plasma can also be altered directly either by venesection or transfusion.

B. Drugs acting on the Red Corpuscles. The most important are those which can increase the amount of hæmoglobin when that is deficient. Strictly speaking, all these have a pathological and not a physiological action, for we know of no drugs which will increase the amount of iron in perfectly healthy blood. These drugs are called **hæmatinics.** They are—

(1) **Iron and its salts.** (2) **Arsenious acid.**

They not only increase the quantity of hæmoglobin in each corpuscle, but also the number of red corpuscles. Their action is much aided by good food, fresh air, and attention to the general health, and especially to the digestive organs. The mode of action of these hæmatinics is very obscure, and will be discussed under each drug. Iron is by far the most important and effectual.

Potassium permanganate, salts of copper, hydrochloric acid, potassium salts and phosphorus have been incorrectly termed hæmatinics.

Indirect hæmatinics are drugs which benefit the patient by removing some obvious cause for his deficiency in hæmoglobin, or anæmia, as it is generally termed. Such are mercury, given for syphilis, quinine for ague.

The size of the red blood-corpuscles is said to be diminished by carbonic acid, quinine, and morphine, and to be increased by oxygen and hydrocyanic acid, and their number is said to be increased by small doses of mercury.

A large amount of sodium chloride causes the red corpuscles to pass rapidly through the walls of the capillaries.

There are some drugs which are not employed therapeutically for their action on the blood, which are nevertheless very important physiologically and toxicologically, for they kill by **altering the composition of the hæmoglobin**, thus preventing its uniting with oxygen. Such are carbonic oxide, which displaces the oxygen from oxyhæmoglobin forming carboxyhæmoglobin. Potassium chlorate, acetanilide, phenazone, phenacetin, pyrogallic acid, potassium permanganate, and nitrites, especially nitrites, convert the hæmoglobin into methæmoglobin, and destroy the red corpuscles.

Phosphorus, sulphuretted hydrogen, turpentine, iodine, and sulphur also reduce oxyhæmoglobin. Phosphorus is especially destructive to the blood.

When freshly drawn blood is exposed to the air its oxidization is diminished by hydrocyanic acid, alcohol, chloroform, quinine, morphine, nicotine, strychnine, and brucine.

C. Drugs acting on the White Corpuscles.—Most if not all drugs which are poisons to amœbæ are poisons to white corpuscles when applied in sufficient strength, which, however, is rarely the case in the human body. All **irritants** which set up inflammation cause the white blood-corpuscles to wander through the capillary walls; and all the **cinchona alkaloids** have the power of arresting this migration: of these, quinine is the most powerful. **Acetanilide** is also powerful. If the quinine is circulating in the capillaries, it prevents the white corpuscles from wandering out; if it is applied to the outside of the vessels, it prevents the corpuscles from wandering away from the vessel through the wall of which they have passed. Arsenic increases the red marrow and leads to the formation of many erythroblasts and myelocytes.

Veratrine applied to white corpuscles outside the body kills them.

Camphor, myrrh, and other aromatics increase their production by increasing absorption from the intestine. Benzoic acid and large doses of colchicum increase the number of polymorphonuclear cells. Small doses of colchicum diminish them.

D. Drugs altering the Coagulability of the Blood.

Those which increase it:—

CALCIUM SALTS, especially the CHLORIDE and LACTATE: MILK, in virtue of its calcium salts; MAGNESIUM OR STRONTIUM CARBONATE OR LACTATE; CO_2.

Those which diminish it:-

CITRIC ACID; ALCOHOL; BILE: large quantities of fluid: OXYGEN.

Therapeutics.—Calcium chloride or lactate is largely given to increase coagulation when bleeding is severe, *e.g.* in operations on jaundiced patients, or in hæmoptysis, or when for other reasons increased coagulability is desired, *e.g.* aneurysm. Citrates have been used to diminish the coagulability in thrombosis and embolism, but it is probable that in order to appreciably increase or diminish the coagulability of the blood larger doses of drugs would have to be used than can be given; and further, many observations on the coagulability of the blood are quite unreliable, for it is difficult to make entirely trustworthy observations on coagulation.

Division III. Drugs acting on the Cardiac Mechanism.

The heart is capable of spontaneously originating impulses which in health begin in the sinus venosus, and spread downwards over the auricle and the ventricle to the apex. It used to be considered that these movements were due to spontaneous impulses proceeding from the cardiac ganglia surrounding chiefly the entrance of the superior and inferior venæ cavæ, the entrance of the pulmonary veins, and the auriculo-ventricular groove; but we now know that there is no certain evidence that these ganglia originate impulses, and most of the evidence goes to show that the contraction of the muscular fibres is due to spontaneous impulses arising in them. This contractile power of the muscular fibres can be inhibited by the vagus, the fibres of which proceed from the vagal nucleus in the medulla, and can be augmented by the augmentor or accelerator nerve-fibres, which proceed downwards in the cervical spinal cord to the upper dorsal nerves, from which they pass through the first thoracic ganglion to the sympathetic, and so to the cardiac plexus, and thence to the heart. We are ignorant of any function for the cardiac ganglia; we know that medullated nerve-fibres lose their medulla in them, and that more fibres proceed from them than enter them. Possibly they have a nutritive function. We have therefore only to consider the action of drugs on the muscular substance of the heart, on the vagal or inhibitory fibres, on the vagal centre, on the augmentor, accelerator, or sympathetic fibres, and on the accelerator centre.

The centres are remarkably easily affected by afferent impulses, proceeding from the heart itself or from almost any part of the body. Our information concerning the action of drugs on the heart of man is necessarily rather inexact, for many experiments are difficult to perform upon the mammalian heart, consequently the cold-blooded animals have been largely used; and as some differences are observed among them—for example, between the frog and the tortoise—it is probable that the deductions drawn from experiments upon the hearts of warm-blooded animals are not wholly applicable to man. In the following account of drugs the action described is that of a moderate dose; the action of a very large dose is generally the reverse of that of a moderate dose.

A. Drugs acting upon the Heart directly.—Our knowledge of these has been gained by studying the action of drugs upon excised hearts or pieces of the heart, and the action of drugs locally applied to the heart, either by gently applying a solution externally, or internally by means of a perfusion cannula. It is difficult to decide whether a drug acts upon the muscular fibre itself, or upon the fine nerves between these fibres, so that no attempt will here be made to distinguish between these actions. As the apex of the heart contains fewer nerves than the rest of the organ, it has been concluded that if a drug acts upon the apex, when it is cut off from the remainder of the heart it acts upon the muscle only; but it would be difficult absolutely to deny the existence of fine nerve-fibres in the apex. The vagus or inhibitory nervous mechanism has been much more studied than the accelerating. The effect of stimulating the muscle may be either to increase the rate or the force of the beat, or to do both; that of stimulating the minute branches of the vagus or its terminations in the heart will be either to diminish the rate or the force of the beat, or both; and the effect of stimulating the accelerator fibres will be just the opposite; and in each of these three cases the effect of paralysing will be the reverse of stimulating. The distinction between a stimulating effect on the terminations of the vagus and a depressing effect on the terminations of the accelerator nerves might be determined by observing the effect of stimulation of each of these nerves before and after the local application of the drug, provided that it has been shown that the muscle itself is not affected by the drug; but this is often difficult to prove. It is easily seen that the complexity of the problem is so great that it will be most convenient to classify the drugs which act locally on the heart by the effect they produce, without attempting to say whether they act on the muscle or nerve terminations.

Drugs increasing the force of the contraction:

(1) **Digitalis.**
(2) **Strophanthus.**
(3) **Squill.**
(4) **Convallaria Majalis.**
(5) **Apocynum.**
(6) **Veratrine.**
(7) **Erythrophlœum.**
(8) **Barium Salts.**
(9) **Suprarenal extract.**
(10) **Physostigmine.**
(11) **Sparteine.**

(In large doses these drugs in frogs always cause arrest of heart in systole; in mammals the final arrest may be in diastole with some, *e.g.* digitalis. **They all slow the pulse.**)

Drugs an important action of which is to increase the rate of the cardiac beat:

(1) **Atropine.**
(2) **Hyoscyamine.**
(3) **Duboisine.**
(4) **Cocaine.**
(5) **Caffeine.**

Drugs an important action of which is to slow the rate of the cardiac beat (see also first list given above):

(1) **Muscarine.**
(2) **Pilocarpine.**

Drugs which increase both the force and the number of the beats:

(1) **Alcohol.**
(2) **Ether.**
(3) **Chloroform.**
(4) **Anæsthetics.**
(5) **Quinine.**

Drugs which markedly decrease both the force and the number of the beats (these are called cardiac depressants):

(1) **Hydrocyanic acid.**
(2) **Aconite.**
(3) **Veratrine.**
(4) **Antimony.**
(5) **Arsenic.**
(6) **Saponine.**
(7) **Chloral hydrate.**
(8) **Bromides.**
(9) **Emetine.**
(10) **Muscarine.**
(11) **Pilocarpine.**
(12) **Phenazone.**
(13) **Acetanilide.**
(14) **Phenacetin.**
(15) **Lobelia.**

Alcohol, chloroform, salicylates, and apomorphine, all in large doses.

B. Drugs acting on the Vagus Centre.—If we observe that the giving of a drug to an animal alters the beat of the heart, but that this alteration can be done away with, either by cutting the vagi or stimulating the peripheral end of the nerve - if one only of them be cut - we may conclude that the drug acted on the vagus centre in the medulla. The excitability of the vagus centre depends so much upon the venosity of the blood and the blood-pressure, and so many drugs that act directly on it also act on other parts of the cardiac apparatus, that a complete list of those influencing it cannot be given. The following are the chief, and reference to the individual drugs will show whether the vagus centre is the most important part of the cardiac apparatus which is affected, and also the period of action of the drug in which the centre is affected.

Drugs which stimulate the vagus centre; that is to say, the pulse is slowed, but this slowing disappears on section of the vagi:

(1) **Aconite.**
(2) **Veratrine.**
(3) **Nicotine.**
(4) **Digitalis.**
(5) **Strophanthus.**
(6) **Squill.**
(7) **Convallaria Majalis.**
(8) **Apocynum.**
(9) **Hydrocyanic acid.**
(10) **Strychnine.**
(11) **Cocaine** (large doses).
(12) **Chloroform.**

(13) **Alcohol.**
(14) **Ether.**
(15) **Chloral hydrate.**
(16) **Butyl chloral.**
(17) **Hydrastis.**
(18) **Suprarenal extract.**
(19) **Pituitary** (posterior part) **extract.**
(20) **Staphisagria (Delphinine).**
(21) **Atropine.**
(22) **Hyoscyamine.**
(These last three only very early in their action.)
(23) **Increased blood-pressure.**
(24) **Venous blood.**

Drugs which depress the vagus centre: Large doses of some of the drugs mentioned in the last list, and drugs which diminish the blood-pressure, such as amyl nitrite and cocaine.

C. Drugs acting on the Accelerating Centre.—We know very little of drugs which depress this. The following probably stimulate it, for their administration renders the pulse still more rapid after the vagi have been cut :—

(1) **Ammonia.**
(2) **Delphinine.**
(3) **Apomorphine.**

D. Drugs acting on Cardiac Nerve Ganglia.—These first slightly stimulate and then profoundly paralyse all nerve ganglia. In the case of the heart, they act chiefly on the vagal ganglia, and so the pulse is at first a little slowed, but soon it becomes rapid, weak, and irregular :—

(1) **Nicotine.**
(2) **Coniine.**
(3) **Lobelia.**
(4) **Gelsemium.**

Therapeutics. The drugs most used for their action on the heart are digitalis, squill, strophanthus, convallaria majalis, caffeine, alcohol, ether, chloroform, strychnine, belladonna, aconite, antimony, and hydrocyanic acid. The therapeutic indication for each of these drugs will be found given under the individual drug.

Division IV. - Drugs acting on the Vessels

These are usually studied either by directl observing alterations in the size of the vessels i some thin structure, such as the ear of a rabbit, th mesentery, tongue, lung, web, or mylo-hyoid of a frog or the wing of a bat ; or the rate of the flow may b observed. This can be conveniently done by cutting some part, as the toes of a frog, and noticing the rate at which the blood flows from the cut vessels with and without the administration of the drug to the animal. It is often necessary that an artificial circulation should be maintained ; for, if not, it might be difficult to prove that the alteration in the quantity of blood flowing from the cut surface was not due to influences acting on the cardiac mechanism. In order to determine if the changes are due to local or central effects, it is necessary to destroy the spinal cord, or to cut the nerves going to the part. When a drug is applied locally, as to the mesentery, and the vessels alter, if the nerves going to the part are not cut, it is difficult to say whether this alteration is direct or reflex.

Drugs are applied to the interior of vessels by injecting them into the circulation.

We know that each vessel is controlled by vaso-constrictor and vaso-dilator nerves, and that these proceed by different paths from the central nervous system, but we do not know upon which set of nerves drugs act; probably some upon the vaso-constrictor, and some upon the vaso-dilator. We can only classify the drugs into those which dilate or contract the vessels by local action, and those which produce these effects through their action on the central nervous system. When a drug acts locally we cannot tell whether it acts on the muscle in the wall of the vessel, or on the nerve terminations.

It of course follows that drugs acting on the heart, or on a large vascular area, will considerably modify the blood-pressure.

A. Drugs acting locally on Vessels.

Drugs which, when locally applied to vessels, dilate them :

(1) **Liquor ammoniæ.**
(2) **Silver nitrate** (strong).
(3) **Zinc chloride** (strong).
(4) **Copper sulphate** (strong).
(5) **Mercuric nitrate.**
(6) **Arsenious acid.**
(7) **Tartarated antimony.**
(8) **Iodine.**
(9) **Chlorine.**
(10) **Mineral acids** (strong).
(11) **Alcohol.**
(12) **Ether.**
(13) **Chloroform.**
(The last three if prevented from evaporating).
(14) **Carbolic acid.**
(15) **Creosote.**
(16) **All volatile oils,** as oil of turpentine, and many substances containing them, as mustard, Armoraciæ Radix, &c.
(17) **Senega.**
(18) **Chrysarobin.**
(19) **Ipecacuanha.**
(20) **Capsicum.**
(21) **Croton oil.**
(22) **Camphor.**
(23) **Cantharidin.**
(24) **Warmth,** however applied, but usually as a poultice.

Irritants.—All the above, as they dilate the vessels, are often spoken of as vascular irritants.

Rubefacients are drugs which, when locally applied to the skin, cause it to become red because of the vascular dilatation induced. All the above drugs are rubefacients.

Vesicants.—Many of these drugs are sufficiently powerful irritants to cause inflammation. If this goes no further than the exudation of plasma from the vessels, and this plasma collects under the epidermis to form vesicles, the drug causing the production of vesicles is said to be a vesicant ; *e.g.* cantharidin.

Pustulants are such of the above drugs as are sufficiently powerful irritants to cause the inflammatory process to proceed to the passage of leucocytes through the walls of the capillaries. They collect in the vesicles, which consequently become pustules ; *e.g.* croton oil.

Escharotics or caustics are the most powerful of all the drugs acting on vessels. Their local application kills the part to which they are immediately applied, and sets up vascular dilatation of the surrounding area; *e.g.* strong nitric acid, zinc chloride, silver nitrate, and arsenious acid.

Counter-irritants. It has been shown by experiments on animals that when the vessels of the skin are dilated by the application of an irritant, those of the viscera, especially those in the abdomen, are often reflexly constricted, leading to a rise of blood-pressure and slight acceleration of the heart and respiration. The same is probably true of man. An irritant is called a counter-irritant when it is applied to the skin with the object of constricting the vessels of the subjacent viscera. It is particularly to be remembered that this is a reflex nervous action, and is in no way due to the withdrawal of blood into the dilated vessels of the skin. Experience has shown that certain organs are best influenced by application of the counter-irritant to a definite part of the skin, *e.g.* a blister applied to the epigastrium relieves gastric pain. Usually it will be found that the area of the skin is that which Head has shown to be associated with the viscus.

The following, when inhaled, dilate peripheral vessels by acting locally on them :

(1) **Amyl nitrite.**
(2) **Ethyl nitrite.**
(3) **Spiritus ætheris nitrosi.**

Drugs which, given some by mouth, others subcutaneously, dilate arterioles by acting locally on them :

(1) **Caffeine.**
(2) **Amyl nitrite.**
(3) **Trinitrin.**
(4) **Sodium nitrite.**
(5) **Ethyl nitrite.**
(6) **Spiritus ætheris nitrosi.**
(7) **Erythrol tetranitrate.**
(8) **Manitol hexanitrate.**
(9) **Nicotine.**
(10) **Belladonna.**
(11) **Hyoscyamus.**
(12) **Stramonium.**
(13) **Antimony.**
(14) **Barium salts.**

Drugs which, given some by mouth, others subcutaneously, contract arterioles by acting locally on them:

(1) **Ergot.**
(2) **Suprarenal extract.**
(3) **Extract of Posterior Part of Pituitary body.**
(4) **Digitalis.**
(5) **Squill.**
(6) **Convallaria.**
(7) **Apocynum.**
(8) **Physostigmine.**
(9) **Pilocarpine.**
(10) **Muscarine.**
(11) **Barium chloride.**
(12) **Veratrine.**

The pituitary extract, although causing general constriction of arterioles, dilates those of the kidney.

In addition to the above the following have been shown by experiments in the laboratory to cause contraction of small arteries through which they circulate:

Salts of copper, zinc, tin, platinum, all cause powerful contraction.

Salts of lithium, calcium, strontium, magnesium, cadmium, nickel, cobalt, and iron cause slight contraction.

Drugs which, when locally applied to vessels, contract them.

These may act in two ways, either by contracting the muscular coat of the vessels, or by coagulating the albuminous fluids around them, the coagulum by its contraction constricting the vessels.

Those which, applied externally, contract the muscular coat of the vessels:

(1) **Cold,** however produced; hence rapidly volatilizing substances, as ether.
(2) **Suprarenal extract.**
(3) **Stypticin.**
(4) **Lead salts.**
(5) **Dilute solutions of Silver salts.**
(6) **Dilute sulphuric acid.**
(7) **Alum.**
(8) **Hamamelis.**
(9) **Acetanilide.**
(10) **Phenazonum.**

All the above, except the last two, are used in medicine to contract vessels.

Those which coagulate the albuminous fluids around the vessels:

(1) **Tannic acid** and all substances containing it; *e.g.* galls, krameria root, kino, hæmatoxylin, hamamelis, cinnamon, eucalyptus gum, and catechu.
(2) **Lead salts.**
(3) **Silver salts.**
(4) **Zinc salts.**
(5) **Copper salts.**
(6) **Alum.**
(7) **Per-salts of iron.**
(8) **Bismuth salts** to a slight extent.

B. Drugs which act on the Vaso-motor Centres.

Drugs which, by their action on the vaso-motor centr dilate the vessels :

(1) **Alcohol.**
(2) **Ether.**
(3) **Chloroform.**
(4) **Chloral.**
(5) **Hydrocyanic acid.**
(6) **Opium.**
(7) **Thyroid gland.**

Some drugs, which in small doses contract vessels b central action, in large dilate them ; *e.g.* digitalis and squill.

Drugs which, by their action on vaso motor centres, caus contraction of vessels :

(1) **Ergot.**
(2) **Digitalis.**
(3) **Squill.**
(4) **Convallaria.**
(5) **Apocynum.**
(6) **Physostigmine.**
(7) **Cocaine.**
(8) **Belladonna.**
(9) **Stramonium.**
(10) **Hyoscyamus.**
(11) **Hydrastis.**
(12) **Strychnine.**
(13) **Salicylic acid.**
(14) **Turpentine.**
(15) **Caffeine.**
(16) **Ammonia** (slightly).

C. Drugs acting on Vaso-motor Ganglia.—These are the same as act on the cardiac ganglia (*see* p. 57). After transitory stimulation they paralyse the ganglia, and hence blood pressure falls. Some think that the rise of blood pressure caused by ergot is due to stimulation of these ganglia.

Astringents are drugs which diminish the size of vessels, and so decrease exudation from them.

Styptics, or **Hæmostatics**, are drugs which stop bleeding. They comprehend **all astringents**, especially cold, adrenalin, lead and copper salts, hamamelis, ergot, tannic acid, and per-salts of iron, which coagulate the blood that is flowing from the vessel, and the clot prevents further bleeding. Matico leaves (B. P. 1885), because of the numerous hairs on their under surface, favour coagulation of blood when locally applied to a bleeding surface. Cobwebs act in the same way.

Therapeutics.—Drugs which locally dilate vessels are applied to stimulate sores to heal ; they promote absorption of inflammatory products, including bacterial toxins which increase the resistance of the body to these toxins, as seen in the application of iodine over certain diseased joints; they act as counterirritants in disease of deep-seated organs, as in the application of a blister for pleurisy. Drugs which by their central action cause dilatation of all the vessels of the body are used in certain forms of heart disease, as angina pectoris; and some suppose that the good they do is brought about by dilating the vessels and so rendering the work of the heart easier. Amyl nitrite and nitro-glycerin are much used for this purpose. Drugs causing general vascular dilatation are also employed to cause dilatation of the vessels of the skin, with the object of thereby leading to an increase of perspiration and an increased radiation of heat. Alcohol, Spiritus Ætheris Nitrosi, and Ipecacuanha amongst others are used in this way.

The most important use of astringents is as styptics; they are also used to check excessive discharges of all sorts, as in diarrhœa, leucorrhœa, &c., and in relaxed conditions of vessels, such as are often seen in pharyngitis.

There is perhaps no better opportunity than this of mentioning emollients and demulcents.

Emollients are substances which soften and protect parts. The word is usually employed for substances applied to the skin.

Common emollients are substances soaked in warm water, as hot fomentations and poultices; fats of various sorts, as lard and lanolin (hydrous wool fat); non-irritating oils, as olive oil, spermaceti, petroleum, vaseline, &c.

Demulcents are substances which protect and soothe parts. They retard the local action of substances dissolved in them, *e.g.* sugar tastes less sweet when dissolved in a demulcent than when dissolved in water. They are generally applied to mucous membranes, especially when unduly dry, and thus they are often used for the mouth.

Instances of them are gelatin, isinglass, glycerin, gum, honey, linseed, starch, spogel seeds, and white of egg.

Division V.—Drugs acting on the Skin.

All those described in the last section act on the cutaneous vessels, but in addition we have—

A. Diaphoretics, or drugs which increase the amount of perspiration. These may do so either by stimulating the sweat centres in the spinal cord, the nerves proceeding from the centres to the glands, the terminations of the nerves in the gland, or the glandular cells themselves; or dilatation of the cutaneous vessels may, by the increase in the amount of blood and the greater warmth, stimulate the glands and lead to an increase of sweat. It is difficult to tell whether drugs acting on the vessels do not also act on the other parts of the mechanism; and it is also difficult to decide whether a drug acts on the gland-cells or the terminations of the nerves, so we will consider diaphoretics under two headings, those which act centrally and those which act peripherally. These are differentiated by observing whether the drug acts after the spinal cord is destroyed, and on a part of the skin after the nerves going to it are cut.

(*a*) *Diaphoretics acting peripherally:* **Pilocarpine** greatly increases the amount of sweat, acting on the nerve terminations in the gland-cells, and certainly not on the vessels. **Muscarine** acts just like pilocarpine. **Nicotine** also acts peripherally. Local applications of **warmth**, and **alcohol** taken internally, perhaps act in the same way in addition to their vascular action.

(*b*) *Diaphoretics acting centrally:*

(1) **Antimony salts.**
(2) **Ammonium acetate.**
(3) **Ammonium citrate.**
(4) **Ipecacuanha.**
(5) **Opium.**

(c) *Diaphoretics whose mode of action is doubtful:* Colchicum, salicine, lobel [illegible]conite, **potassium citrate and acetate.** All these, exce[illegible]he last two, are very feeble.

When a diaphoretic [illegible] very powerfully it is called a **Sudorific.**

B. **Anhidrotics,** or **Antihidrotics,** drugs which diminish the amount of perspiration. The part on which these act is determined in the same way as in the case of diaphoretics.

(a) *Anhidrotics acting peripherally:* **Atropine** is very powerful, acting on the ends of the nerves in the glands; **hyoscyamus, stramonium,** and **agaricin** act in the same way. The local application of **cold** has a similar action.

(b) *Anhidrotics the mode of action of which is doubtful* (the action of all these is very slight):

(1) **Acids.**
(2) **Nux vomica.**
(3) **Quinine.**
(4) **Zinc salts.**

Therapeutics.—Diaphoretics are used for three purposes: either to increase the amount of sweat because that of the urine is failing, and for this purpose pilocarpine is largely used; or in the hope that poisons may be excreted by the sweat, hence the use of pilocarpine in uræmia; or as mild antipyretics, in order to increase the loss of heat by increased evaporation: for this purpose alcohol, ipecacuanha, ammonium acetate, and opium were formerly much employed, but of late years much more efficient antipyretics have been discovered.

Anhidrotics are used either for general conditions, as phthisis, or for local conditions, as sweating of the feet; but they are not of great use in medicine.

We do not know of any drugs which will alter the composition of the sweat, except in so far as that certain drugs may be excreted in the sweat when taken internally: such are iodine, potassium iodide, succinic, tartaric, and benzoic acids, the last in the form of hippuric acid.

We have no knowledge of the effects of drug the sebaceous secretion.

Certain drugs when taken internally in l doses produce a rash on the skin, possibly bec in the course of their excretion through the they irritate it. Such are—

(1) **Copaiba.**
(2) **Cubebs.**
(3) **Bromides.**
(4) **Iodides.**
(5) **Turpentine.**
(6) **Belladonna.**
(7) **Chloral.**
(8) **Opium.**
(9) **Quinine.**
(10) **Salicylic acid.**
(11) **Arsenical salts**
(12) **Acetanilide.**
(13) **Phenazonum.**
(14) **Phenacetin.**
(15) **Chloralamide**
(16) **Antitoxins.**
(17) **Serums.**
(18) **Aconite.**
(19) **Silver** salts may colour the ski

Division VI.—Drugs acting on the Urinary System.

1. *Drugs increasing the quantity of urine secret* These are called diuretics. The kidney is a dou organ with two distinct varieties of epithelium; is particularly well supplied with vessels and va motor nerves, and is also profoundly under t influence of variations in the quantity of blo flowing through it; hence it is, with our prese state of knowledge, impossible to say how ma diuretics act, but the table on page 68, modifie from Lauder Brunton's work, shows the various wa in which they probably act, many in more wa than one. Probably the most powerful is extract the posterior part of the pituitary body, which ha been shown by Schäfer to cause dilatation of th renal vessels and a greatly increased flow of urine.

Therapeutics.—Diuretics are used in cardiac an pulmonary diseases when, owing to the general vascular disturbance, the quantity of urine falls below th normal standard. Also in diseases in which there i excess of fluid in certain parts of the body; for example, pleuritic effusion and ascites, with the object of getting rid of as much fluid as possible by the kidneys. Also they may be used to dilute the urine, *e.g.* when it is prone to deposit its solids. Lastly, in certain forms of kidney disease, although in these maladies it is always a question how far it is desirable to stimulate diseased organs. It is of great importance to remember that diuretics may act in many different ways, that there are many causes for diminution in the quantity of urine secreted, and that it is difficult to say in any particular case what is the cause of the decrease in the quantity secreted. Therefore it is usual to give diuretics in combination, in the hope that if one of them does not have the desired result another will.

2. *Drugs diminishing the quantity of urine secreted.*—These are such as produce acute inflammation of the kidney when given in large doses; *e.g.* turpentine, cantharides, phosphorus. They are never given for this purpose in medicine.

3. *Drugs rendering the urine acid.*—The chief official drug that can do this effectually is probably **benzoic acid**, for in its passage through the kidney it is converted into hippuric acid. Benzoic acid is therefore given when from any cause the urine undergoes alkaline decomposition anywhere within the urinary passages. Acid sodium phosphate is the natural acid of the urine, and its administration by the mouth increases the acidity of that fluid. Salicylic acid will, to a slight extent, increase the acidity of the urine, as will very large doses of citric or tartaric acid.

4. *Drugs which render the urine alkaline.*—Those **organic salts of the metals potassium, sodium,**

- Raise arterial pressure
  - Generally
    - Increased cardiac action
      - **Digitalis group,**
      - **Caffeine & Theobromine,**
      - **Alcohol.**
    - General vascular contraction
      - **Digitalis group,**
      - **Strychnine,**
      - **Caffeine & Theobromine,**
      - **Cold to skin.**
  - Locally in kidney
    - Contract efferent vessels
      - Act on vaso-motor centres
        - **? same as above.**
      - Locally on kidney
        - **Broom,**
        - **Caffeine & Theobromine,**
        - **Buchu,**
        - **Uva ursi,**
        - **Juniper,**
        - **Turpentine,**
        - **Copaiba.**
    - Dilate, chiefly locally, renal vessels
      - **Pituitary Extract,**
      - **Caffeine & Theobromine,**
      - **Urea.**
- Act on secreting nerves or renal cells
  - Increase water excreted
    - **Urea,**
    - **Caffeine & Theobromine,**
    - **Alcohol,**
    - **Calomel.**
  - Increase water and solids excreted
    - **Potassium acetate,**
    - **Potassium citrate,**
    - **Potassium nitrate,**
    - **Sodium citrate,**
    - **and other salines.**

lithium, calcium which are oxidised in the body to carbonates and excreted as such by the kidneys, such as the tartrates and citrates, and to a less extent the acetates, will do this. The carbonates have the same effect. Nitric acid is said to increase the amount of ammonia in the urine, and thus to render it slightly alkaline. Organic ammonium salts and ammonium carbonate given internally do not render the urine alkaline, because they are decomposed in the body, urea being probably formed.

Lithontriptics are drugs which prevent the deposition in the urinary passages of the solids of the urine. If this fluid be acid, uric acid often crystallizes out, forming gravel or uric acid calculus; less often calcium oxalate crystallizes, giving rise to calcium oxalate calculus. When there is any likelihood of the formation of either of these calculi, alkalies may be given. If the urine is undergoing alkaline decomposition phosphates are liable to crystallize out. In this case the object will be to render the urine acid and aseptic. This will be attained by giving benzoic acid, salicylic acid, the acid phosphates, and urinary antiseptics.

Therapeutics.—The chief use of alkalies is to diminish the acidity of the urine, so as to render the precipitation of uric acid unlikely; or to render it alkaline, so as to attempt to dissolve a uric acid calculus. We know of no drug which will dissolve an oxalate of lime calculus. Alkalies are also given to gouty subjects, partly to alkalize the blood, but also partly to alkalize the urine, for such persons are very prone to deposit uric acid in the urine. Potassium urate is much more soluble than sodium urate, and lithium urate is perhaps even more soluble; citrates and acetates are not likely to upset the digestion, consequently the drugs most used are the citrates of potassium and lithium. Copious draughts of water, by diluting the urine, aid in preventing the deposition of uric acid or oxalate of lime calculi. Natural alkaline waters are largely used.

5. *Drugs destroying bacteria in the urine.*—If the urine is retained in the bladder by stricture or from any other cause, it often undergoes alkaline decomposition as a result of bacterial infection, and the same result may be brought about by the admixture of pus with it. Bacteria may also exist in weakly acid urine. The following drugs are reputed to hinder the growth of bacteria in the urine, but the action of all but the first three is very feeble. Some act by rendering the urine acid (*see* p. 67). Hexamine by the rapid formation of formaldehyde provided the urine is acid. So if this is alkaline acid sodium phosphate is given with hexamine.

(1) **Benzoic acid.**
(2) **Acid Sodium Phosphate.**
(3) **Hexamine.**
(4) **Boric acid.**
(5) **Salicylic acid.**
(6) **Uva ursi.**
(7) **Many volatile oils.**
(8) **Copaiba.**
(9) **Cubebs.**
(10) **Oil of sanders wood.**

6. *Drugs altering the composition of the urine.*—Almost any drug will do this, either because it is excreted in the urine, or because it sets up some changes in the body the products of which are excreted in the urine; but here we shall only refer to certain striking examples.

Turpentine, cantharidin, and salicylic acid in large doses will cause blood to appear in the urine, because they set up inflammation of the kidney.

Potassium chlorate, all nitrites, acetanilide, pyrogallic acid, poisoning by the mushroom (*Helvella esculenta*), and transfusion of animals' blood, break up red blood-corpuscles, and the products are excreted in the urine, rendering it dark. Large doses of mineral acids, arsenic, and naphthol are said occasionally to produce the same result.

Phosphorus in large doses causes leucine and tyrosine to appear in the urine, and the ammonia is greatly increased.

The saline diuretics increase the solids of the urine.

The chrysophanic acid in rhubarb and senna makes the urine, if it is acid, a brownish colour; if it is alkaline, a purplish red. Logwood renders alkaline urine red or violet. Santonin colours acid urine yellow or greenish yellow, and alkaline urine red. Carbolic acid, naphthalene, creosote, and other preparations of tar, as well as the arbutin in uva ursi, make it dark greenish brown. Picric acid makes it a bright yellow, and methyl violet a dark blue.

The urine of persons poisoned with carbonic oxide remains sweet for months.

Poisoning by carbonic oxide, curare, amyl nitrite, fusel oil, and turpentine, and sometimes mercury, morphine, chloral, prussic acid, sulphuric acid, alcohol, lead compounds, and salicylic acid, leads to the appearance in the urine of a body which like sugar reduces Fehling's copper solution. In most of these cases this body is not glucose, but glycuronic acid; for although it reduces blue copper solutions, it does not undergo alcoholic fermentation on the addition of yeast. The administration of phloridzin or phloretin leads to the production of genuine glucose in the urine.

Other drugs cause a peculiar odour in the urine; for example, the smell of violets produced by turpentine. The aromatic odour of cubebs and copaiba can be detected in the urine after the administration of these bodies.

Lead, if taken for long periods, produces chronic interstitial inflammation of the kidney. It is stated that rarely mercury will do the same.

7. *Drugs acting on the bladder and urethra.*—The only ones of any practical value are **sedatives** to the urinary tract.

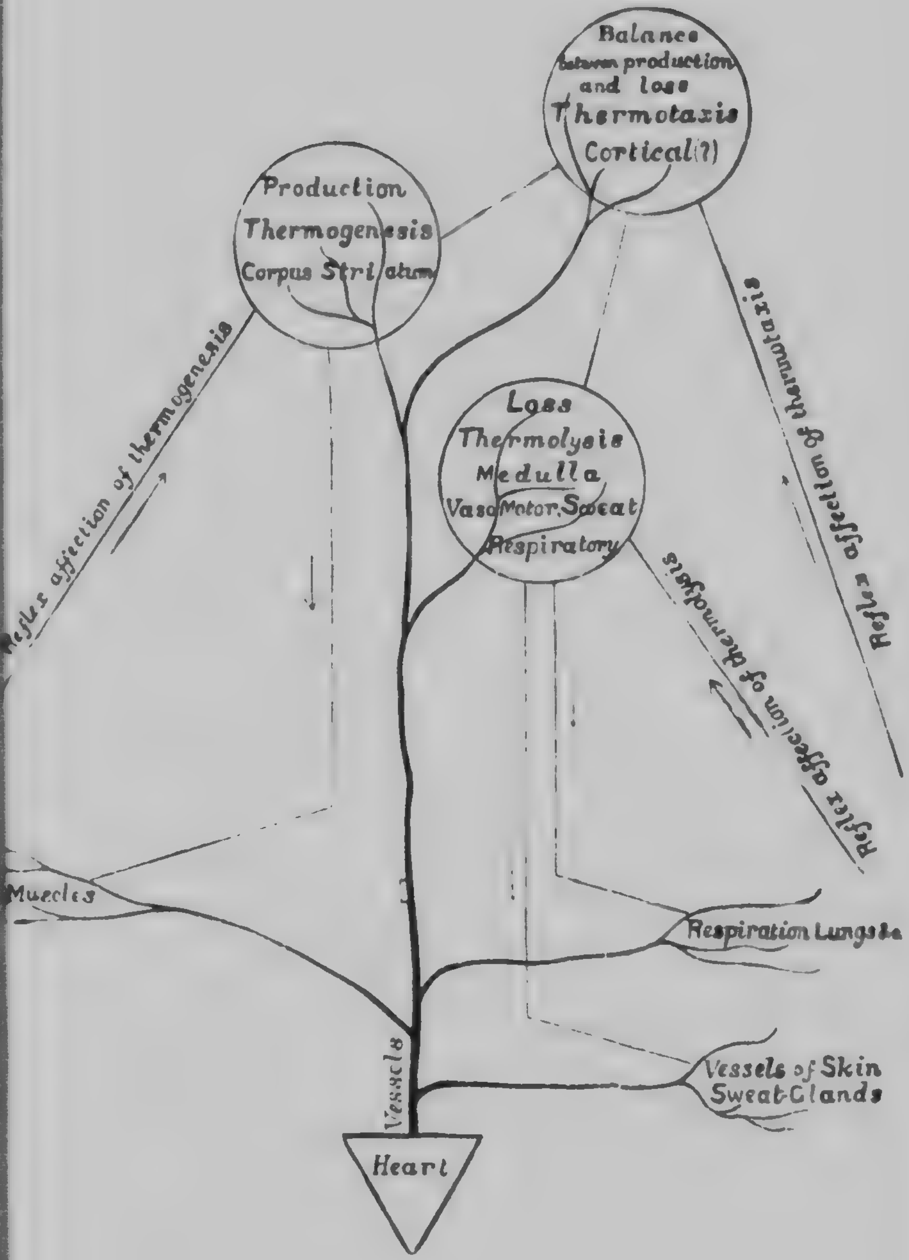
If the urine is decomposing, drugs preventing its decomposition fall under this head. Other sedatives are **opium, belladonna, hyoscyamus, stramonium, pareira, buchu, uva ursi, couch grass, cissampelos,** and **hygrophila,** which are direct sedatives to the vesical and urethral mucous membrane. If the urine is excessively acid, alkalies are urinary sedatives.

Urinary sedatives are used very largely in cases of cystitis and urethritis, whatever the cause may be. Local astringent and antiseptic injections are also employed.

Division VII.—Drugs acting on the Bodily Heat.

A. Antipyretics, or Drugs which decrease the Bodily Temperature.—There are few drugs which can markedly lower the temperature in health. Some, it is true, will cause the temperature to fall below normal if given to a healthy man in large enough doses to induce severe collapse. The word antipyretic is limited to those drugs which bring down the temperature when it is raised owing to disease. We know that the greatest amount of heat is produced in the muscles, and there is some evidence that there is a special part of the brain, perhaps the corpus striatum, presiding over this production; that heat is lost mostly by radiation from the vessels of the skin and by the evaporation of sweat, and that these vessels and the sudoriparous glands are under the control of the central nervous system. Heat is also lost through the lungs. As the production and loss are in health so accurately adjusted, many observers believe that there is a part of the cerebrum whose function it is to maintain the balance between the production and the loss. Also all parts of this complex mechanism are supplied with blood-vessels, and must be affected by the quantity and composition of the blood supplied to them.

It may also be that the part of the central nervous system which presides over the loss of heat (thermolysis), that which presides over the production of heat (thermogenesis), and that which possibly presides over the balance between the production and the loss (thermotaxis), can, each of them, be influenced by afferent impulses reaching them from various parts of the body, and thus we see each of these three functions can probably be reflexly affected. (*See* diagram on p. 73.)


Balance between production and loss
Thermotaxis
Cortical(?)
Production
Thermogenesis
Corpus Striatum
Loss
Thermolysis
Medulla
VasoMotor, Sweat
Respiratory
Reflex affection of thermogenesis
Reflex affection of thermotaxis
Reflex affection of thermolysis
Muscles
Respiration Lungs &c
Vessels of Skin
Sweat Glands
Vessels
Heart

Antipyretics which increase the loss of heat.—All sudorifics and all dilators of the cutaneous vessels act as antipyretics. Cold, such as a cold bath, increases the loss of heat by direct abstraction.

Drugs which probably diminish the production of heat.—Our knowledge about these is at present uncertain, but it is very probable that **phenacetinum**, **phenazonum** (antipyrin), and **acetanilidum** (antifebrin) diminish the production by their action on the corpus striatum; and that **quinine**, **salicylic acid**, and **salicin** also diminish the production; by directly diminishing metabolism. A cold bath not only abstracts heat, but, after it has been in operation some little time, diminishes the production.

Antimony, aconite, and digitalis are probably antipyretic through their effect on the circulation, but precisely how they and benzoic acid act is not known. Sometimes the removal of some irritation which may be acting reflexly lowers the temperature. In this way purgatives are occasionally antipyretics.

Therapeutics.—The use of antipyretics is to lower the temperature in fever.

Drugs which increase the loss of heat were formerly popular as antipyretics, especially alcohol, nitrous ether, antimony, ipecacuanha, and opium, but now they are not much used. Cold is more often employed, either by cold sponging, ice, or a cold bath. Sponging with hot water will, by the vascular dilatation and subsequent sweating it induces, reduce a febrile temperature.

Of the drugs which alter the production, acetanilide and phenazonum are dangerous because of the collapse they may produce; quinine and salicylic acid are rather uncertain, except in ague and rheumatic fever respectively. Phenazonum and phenacetinum are most in demand. They are certain antipyretics. Phenacetin is very safe, but less powerful. They are quickly absorbed, and so act promptly; they are far more powerful than any drugs which act by increasing the loss of heat, and these are very uncertain in their action, often not lowering the temperature at all. Another reason for preferring drugs which diminish thermogenesis is that it is more rational to lower temperature by decreasing the production of heat than by increasing the loss, for then the production will, if anything, go on faster, in consequence of the attempt to compensate for the increased loss. Antipyretics, however, should be rarely given, for probably fever is often beneficial.

B. Drugs which cause a rise of Temperature.—Belladonna, picrotoxin and cocaine in poisonous doses may do this, and β-tetrahydronaphthylamine may cause a rise of many degrees in a few hours. How these act is not certainly known.

Tuberculin, various albumoses, and certain animal poisons such as that of shell-fish will cause a rise of temperature. Their mode of action is unknown.

We know of no drugs acting on thermotaxis.

Division VIII.—Drugs acting on Respiration.

Respiration can be modified by such very various influences that it is difficult to decide upon the exact mode of action of any drug which affects it. For example, alterations in the blood and in the air will modify it; the respiratory centre itself may be influenced, either directly, or reflexly from almost any organ in the body; or, again, the movements of the respiratory muscles themselves may be interfered with; and, lastly, respiration is much under the influence of the circulatory apparatus. Furthermore, the chief object in medicine is to remove the cause of the respiratory difficulty rather than to act upon respiration itself.

MICROCOPY RESOLUTION TEST CHART

APPLIED IMAGE inc

We have already spoken of those drugs which produce changes in the blood and the circulation, and the consideration of those modifications of the temperature, moisture, and pressure of the air which are of value in medicine belongs to a book on general therapeutics. We will therefore now consider the respiratory drugs under the following heads:

A. Drugs altering the Composition of the Air inhaled. It is found convenient to administer some drugs, although they are not given for their influence on respiration, by making the patient inhale them; such are anæsthetics and amyl nitrite.

Some drugs when inhaled are particularly irritating to the bronchial mucous membrane, causing dilatation of the vessels, increased secretion, and reflexly cough from the stimulation of the sensory nerves of the bronchial mucous membrane.

Such are cold dry air, iodine, bromine, chlorine, senega ipecacuanha, sulphurous anhydride, nitric acid fumes, ammonia, and tobacco. These are rarely used therapeutically as inhalations, and their inhalation is to be particularly avoided in irritable conditions of the bronchi.

The drugs which, when inhaled, are **soothing** to the bronchial mucous membrane are—

Hydrocyanic acid.
Conium.

These are rarely employed.

Inhalations which are used to **stimulate** the bronchi, that is to say, to increase their vascularity, secretion, and muscular power, are—

Carbolic acid, gr. 20.
Cajuput oil, ♏20.
Creosote, fl. oz. ss.
Cubebs oil, fl. oz. ss.
Tinctura Benzoini Composita, fl. oz. ss.
Vapor Olei Pini Sylvestris (B. P. 1885).

The amounts given after each are the quantities that should be added to a pint of water at 55° C.

Inhalations which are used to **disinfect foul** secretions from the bronchial mucous membrane are those of—

(1) **Creosote.**
(2) **Iodoform.**
(3) **Mild solutions of benzoin.**
(4) **Carbolic acid.**
(5) **Sulphurous anhydride.**
(6) **Oil of juniper.**
(7) **Oil of cubebs.**

Inhalations for **relieving spasm** of the bronchial tubes are those of

(1) **Conium.**
(2) **Stramonium.**
(3) **Chloroform.**
(4) **Ether.**
(5) **Amyl nitrite.**

B. Drugs acting directly on the Respiratory Centre.—If the drug, when injected into the carotid artery, very quickly produces its effect on respiration, it is concluded that it acts on the respiratory centre. Another experiment, often used to determine whether the drug acts on the centre, or on the vagal terminations in the lung, is to cut the vagi and to observe whether it acts similarly before and after the section.

Drugs which directly **stimulate** the respiratory centre are

(1) **Strychnine.**
(2) **Ammonia** (very powerful).
(3) **Belladonna.**
(4) **Stramonium.**
(5) **Hyoscyamus.**

Drugs which **depress** the respiratory centre are—

(1) **Physostigmine** (very powerful).
(2) **Chloral.**
(3) **Chloroform.**
(4) **Ether.**
(5) **Alcohol.**
(6) **Opium.**
(7) **Hydrocyanic acid.**
(8) **Codeine.**
(9) **Heroin.**
(10) **Virginian Prune.**
(11) **Aconite.**
(12) **Veratrine.**
(13) **Nitrites.**
(14) **Gelsemium.**
(15) **Tobacco.**
(16) **Cocaine.**
(17) **Conium.**
(18) **Caffeine.**

Alcohol, Ether, Chloroform, and Caffeine slightly **excite before they depress.**

Therapeutics.—The drugs which excite th respiratory centre may be used when there is an difficulty in respiration, especially with the vie of increasing the force of the respiratory act whils other means are employed to get rid of the cause c the difficulty. They are, of course, most frequentl required in diseases of the lungs, especially bronchitis. Ammonia is often employed, as it is also powerful expectorant; and belladonna is useful whe there is too much secretion from the bronchial tube

Substances which depress the respiratory centr are very little needed for this action; but the centr for the reflex act of coughing is in the close neighbourhood of the respiratory centre, and **opium, hydrocyanic acid, codeine, diamorphine, Virginian prune conium,** and **ipecacuanha** are often very valuabl in allaying the continual hacking cough which s frequently accompanies disease of the heart and lungs

The drugs which relieve cough are very numerous for it may be reflexly set up by irritation of so man peripheral parts, viz. nose, throat, pharynx, ear teeth, larynx, trachea, bronchi, lungs, pleura, stomach and liver; and consequently its removal may depend upon the removal of peripheral irritation in any o these organs.

C. Drugs affecting the Bronchial Secretion.

(*a*) *Those increasing it:*

(1) **All alkalies,** especially **carbonate** and other **salts of ammonium.**
(2) **Ipecacuanha.**
(3) **Senega.**
(4) **Squills.**
(5) **Turpentine.**
(6) **Camphor.**
(7) **Benzoin.**
(8) **Balsam of Peru.**
(9) **Balsam of Tolu.**
(10) **Antimony salts.**
(11) **Sulphur.**
(12) **Iodine.**
(13) **Tobacco.**
(14) **Pilocarpine.**
(15) **Many volatile oils.**
(16) **Quillaia.**
(17) **Apomorphine.**
(18) **Terebene.**
(19) **Tar.**

b) *Those decreasing it :*

(1) **Acids.**
(2) **Belladonna.**
(3) **Stramonium.**
(4) **Hyoscyamus.**

Many authorities think that under some circumstances alkalies decrease the secretion.

c) *Those disinfecting it.*—Drugs which, when inhaled, act in this way have already been mentioned. Copaiba, cubebs, and many volatile oils are excreted partly by the bronchial mucous membrane, and thus will disinfect the secretion.

Therapeutics.—In bronchitis, remedies which increase the secretion are used when it is so viscid that it sticks to the tubes and cannot be coughed up; and those which decrease it are employed when it is too watery to be easily expectorated. The use of the disinfectants is obvious.

D. Drugs relaxing Spasm of the Muscular Coat of the Bronchial Tubes, or Antispasmodics.—The following relax contraction of the bronchial tubes:

(1) **Stramonium,**
(2) **Atropine,**
(3) **Hyoscyamus,**
(4) **Grindelia,**
(5) **Lobelia,**
(6) **Amyl Nitrite,**
(7) **Chloroform,**
(8) **Ether,**
(9) **Urethrane.**

The first five paralyse the terminations of the vagus in, and the last four act directly on, the bronchial muscles. It is very likely, judging by their analogous action in other parts of the body, that the following drugs also relax bronchial spasm:

Opium, Chloral, Cannabis Indica, and Conium.

Therapeutics.—Stramonium is of great use in asthma, and this and the other drugs may be employed for cases of bronchitis in which it is probable that the irritation caused by the inflammation of the tubes sets up spasm of them.

E. Drugs causing spasm of the muscular coat of the bronchial tubes—

Muscarine, Pilocarpine, and Physostigmine excite the vagal endings and induce typical bronchiolar constriction.

which is abolished by Atropine. Barium, Veratrine, Bron and the salts of many of the heavy metals (e.g. Gold) pro constriction which is not influenced by Atropine.

F. Drugs acting on the Vessels of the Bronch These are the same as have been already descri (p. 58) as acting on the vascular system generally, adrenalin, pilocarpine, and muscarine, although t constrict vessels generally, dilate those of the lun

G. Expectorants. The modes of action of dr acting on the respiratory system are so complex t it is usual to regard most of them clinically sim as drugs which hinder or aid the expectoration the contents of the bronchial tubes. Those whi aid it are divided into two groups, named aft their action, not on the lungs, but on the circulatio

1. *Stimulating expectorants.*—These are stimulants to t circulation generally. They are—

(1) **Acids.**
(2) **Ammonium salts.**
(3) **Senega.**
(4) **Squills.**
(5) **Benzoin.**
(6) **Benzoic acid.**
(7) **Balsam of Tolu.**
(8) **Balsam of Peru.**
(9) **Turpentine** prepar tions.
(10) **Terebene.**
(11) **Oleum Abietis.**
(12) **Nux vomica.**
(13) **Sulphur.**

2. *Depressing expectorants.* These depress the genera circulation. They are—

(1) **Alkalies.**
(2) **Antimony salts.**
(3) **Ipecacuanha.**
(4) **Senega.**
(5) **Lobelia.**
(6) **Pilocarpine.**
(7) **Apomorphine.**
(8) **Saponin.**
(9) **Potassium iodide** (very slightly depressant).

Therapeutics.—It is almost impossible to la down any general directions. The prescriber mus consider in any case before him whether he wishes to stimulate or to depress the circulation, to increase or to diminish or to disinfect the expectoration, to stimulate the respiratory centre, to overcome spasm of the bronchial tubes, or to allay a hacking cough; and he must combine his remedies according to the answer he makes to these questions. Warmth to the chest and warm drinks are sedative, and increase the amount of secretion. Cold and cold drinks have an opposite effect.

H. Drugs which in Man sometimes produce Cheyne Stokes breathing—

These are morphine, potassium bromide, and chloral hydrate. In animals the following in addition may do it: picrotoxin, muscarin, digitalin, strychnine, and ammonium carbonate.

Division IX.—Drugs acting on the Digestive Apparatus.

A. Drugs acting on the Teeth.—Soaps and powders are used for cleaning the teeth. The basis of most tooth powders is chalk, which acts mechanically; charcoal is sometimes used in the same way. As the food is very liable to collect and decompose between the teeth, antiseptics, as quinine, borax, and carbolic acid, are often mixed with tooth powders. Astringents, such as rhatany and areca nut, are employed if the gums are too vascular. Mineral acids and alum are injurious to the teeth if used for a long time, and iron is liable to stain them; therefore these substances are best taken through a quill, and should not be used as gargles for long together.

Toothache may be relieved by local anodynes, as creosote, or strong carbolic acid. The tooth is plugged with cotton wool soaked in one of these. Clean cotton wool is placed over the carbolized wool to prevent the acid from reaching the mouth. This method may damage the tooth pulp.

B. Drugs acting on the Salivary Glands.—Much attention has been devoted to the submaxillary gland of the dog, and there is no reason for supposing that the other salivary glands of that animal or of other creatures differ markedly from it. We know that the submaxillary gland is under the influence of the chorda tympani nerve, which contains vaso-dilator fibres, and also some which directly modify the secretion of the gland apart from the secondary effects, due to the alterations in the vessels, obtained when the chorda tympani is stimulated. This nerve has its centre in the medulla, and is capable of being excited reflexly by stimulation of many nerves, even the sciatic, but especially by stimulation of the gastric branches of the vagus, and by the terminations in the tongue and mouth of the glosso-pharyngeal and gustatory nerves. The gland is also supplied with sympathetic branches which proceed from the cervical sympathetic trunk; these are vaso-constrictor, and can also modify the quality of the secretion, but we do not know so much about them as we do about the chorda tympani. Drugs which increase the amount of saliva have been called sialogogues; those which decrease it, antisialogogues. It is clear that there are very many ways in which each of these might act, but here it will suffice to enumerate only those ways in which they are known to act.

1. *Sialogogues acting either on the secretory cells or upon the terminations of the nerves in them.*—Of these jaborandi has been most studied, and, by means of the following experiments, it has been proved to act either on the cells themselves or the terminations of the nerves in them. It acts equally well after section of all the nerves going to the gland. It acts when it is injected directly into the gland but is prevented from reaching the general circulation. If it has been given, stimulation of the chorda or sympathetic produces no more effect on

the amount of secretion than can be easily explained by the vascular effects.

Sialogogues falling under this heading are—

(1) **Pilocarpine,**
(2) **Muscarine,**
(3) **Compounds of Iodine,**
(4) **Mercury,**
(5) **Physostigmine.**

The last probably acts also by stimulating the centre in the medulla, for section of the chorda tympani decidedly lessens the secretion caused by them. Physostigmine soon ceases to cause an increase of the secretion, for it tightly contracts the vessels of the gland.

2. *Sialogogues acting on the ganglionic cells :*

Nicotine, and to a less extent the other drugs acting on ganglion cells (see p. 119), first excite and then stop salivary secretion.

3. *Sialogogues acting reflexly by stimulating the peripheral ends of afferent nerves.*—Of these there are two important varieties :

(*a*) Those stimulating the gustatory and glosso-pharyngeal nerves in the mouth :

(1) **All Acids** and
(2) **Acid Salts.**
(3) **Chloroform.**
(4) **Alcohol.**
(5) **Ether.**
(6) **All pungent substances,** as mustard and ginger.

(*b*) Those stimulating the vagus in the stomach :

Most emetics, especially **Antimony** and **Ipecacuanha.**

4. *Antisialogogues acting either on the secreting cells or the terminations of the nerves in them.*—Of these atropine has been most studied, and it is proved to act directly on the gland by the fact that the administration of it prevents any increase of salivary secretion on stimulation of the chorda, although the vessels dilate as usual. It is highly probable that it acts upon the nerve terminations, because even after considerable doses, quite paralysing the secretion of chorda tympani saliva, stimulation of the sympathetic will still induce secretion.

Antisialogogues falling under this heading are

(1) **Belladonna**, (3) **Stramonium**.
(2) **Hyoscyamus**,

5. *Antisialogogues acting reflexly by depressing peripheral ends of afferent nerves.*—Alkali opium, and any substances which allay irritation the mouth. Part of the effect of opium is due its depressing action on the medullary centre.

Therapeutics. A deficiency in the amount saliva secreted is seen most markedly in fever, whe the mouth becomes very dry, and the patient complains of thirst. Sometimes it is a disease in itsel and the origin of this malady is then probabl nervous. It is a prominent symptom of belladonn poisoning. In fever, acid drinks, especially thos containing carbonic acid gas or lemonade, are o use as sialogogues. Drinks which relieve this febril thirst are called **Refrigerants**. For the disease know as "dry mouth" pilocarpine has been used, an it will relieve the dryness due to belladonna poisoning. Excessive salivary secretion is hardly met with except as a symptom of poisoning, especially by mercury and pilocarpine. In some forms of indigestion the saliva has a very unpleasant taste, and may even be diminished in quantity, but then the indication is to treat the indigestion.

C. Drugs acting on the Stomach.—Strictly speaking, we ought to consider these under the following heads:—Those which, by modifying the secretion of hydrochloric acid or pepsin, influence the conversion of proteids into peptones and albumoses. Those which influence the property possessed by the gastric juice of curdling milk. Those which affect its antiseptic power by modifying the secretion of acid. Those which modify the secretion of mucus. Those which influence the nerves, the vessels, or the movements of the stomach. Lastly, those which are emetics. Our knowledge, however, is not sufficient to enable us to do this, and the most useful classification is into those affecting the secretion of gastric juice as a whole, the secreted contents, the vessels, the nerves, the movements, and emetics.

1. *Drugs increasing the amount of gastric juice secreted.* These are usually called stomachics, and include a great many substances. Pawlow's researches show that the most powerful excitant of the flow of gastric juice is appetite, hence the sight of food which excites appetite excites gastric flow; food which is not appetising and the mere mechanical stimulation of the mouth or stomach do not do so. Many drugs, *e.g.* bitters and aromatics, increase the gastric flow because they act on the gustatory nerves in the mouth, increasing the appetite.

The drugs which increase the flow of gastric juice are

(1) **Aromatics.**
(2) **Bitters.**
(3) **Pungent substances** (pepper, mustard, horseradish).
(4) **Meat extracts.**
(5) **Alcohol.**
(6) **Ether.**
(7) **Chloroform.**
(8) **Water.**

Therapeutics. Stomachics are very largely used for the purpose of increasing the secretion of gastric juice in cases of dyspepsia.

2. *Drugs decreasing the amount of gastric juice secreted.*

(1) **Alkalies.** (2) **Fats.** (3) Many of those in the last list if given in large doses, *e.g.* alcohol, ether, chloroform.

Therapeutics.—Alkalies, especially sodium bicarbonate, are frequently given when there is a hypersecretion of gastric juice. They inhibit this and rest the glands, which after a period of quietude pour out a normal juice. This gave rise to the erroneous impression that alkalies increased gastric secretion.

Fats. *e.g.* olive oil, are given to lessen the secre of acid in cases of gastric or duodenal ulcer.

8. *Drugs altering the composition of the gas contents.*– Acids and alkalies naturally modify reaction of the gastric contents. For this purp dilute mineral acids are often prescribed to be ta about two hours after a meal, in cases in which cause of indigestion is thought to be that the amo of hydrochloric acid secreted is deficient. In ca of indigestion in which, from the nature of vomited matters or from any other reason, it is co sidered that there is an excess of acid in the stoma alkalies are given at or after meal-times, the favour drug being sodium bicarbonate.

Pepsin is given, usually in combination w dilute hydrochloric acid, when it is probable that t cause of the indigestion is the secretion of too sm an amount of pepsin; but in this, as in every oth variety of dyspepsia, it is far more important remove the cause of the indigestion than to endeavo to modify the composition of the secreted gastric juic

Many attempts have been made to try by th administration of **antiseptics** to prevent ferment tion and putrefaction from going on in the stomac but with a limited success, for a sufficient do is frequently deleterious. Here even more than i the last case the right treatment is to remove th cause of the fermentation or putrefaction.

Drugs that have been used for this purpose are –

(1) **Cyllin.**
(2) **Carbolic acid.**
(3) **Iodoform.**
(4) **Boric acid.**
(5) **Creosote.**
(6) **Eucalyptus.**
(7) **Thymol.**
(8) **Sodium hyposul phite.**
(9) **Sulphurous acid.**
(10) **Naphthol.**
(11) **Bismuth Salicylate**
(12) **Salol.**

1. *Drugs which dilate the vessels of the stomach.* The vessels of the stomach are very sensitive to irritation. They easily dilate upon mechanical irritation, and the presence of food, especially peptones, causes the vascularity of the mucous membrane to increase. Within limits greater vascularity is an advantage, for it not only favours the secretion of gastric juice, but it facilitates absorption.

The substances which increase the vascularity of the stomach are all stomachics, dilute mineral acids, the drugs which have already been enumerated as irritants generally, and squill, digitalis, colchicum, senega, copaiba, cambogia, guaiacum, and veratrine. This is a very long list, and many of the substances in it are never employed for their irritant effect: in fact, the only ones in common use are the stomachics: the others are far too powerful; even small doses of them set up inflammation of the gastric wall, which is also produced by overindulgence in stomachics, as we constantly see in the gastritis induced by alcohol. The therapeutic indications for this class of drugs are the same as those for stomachics generally.

Gastro-intestinal irritants.—In describing the individual actions of drugs the statement is frequently made that they are gastro-intestinal irritants, and this is a convenient opportunity for describing the symptoms produced in health by these drugs. If the drug has a caustic action, as many gastro intestinal irritants have, the swallowing of it will cause considerable pain in the mouth and pharynx; in a short time these parts will become severely inflamed, and consequently very much reddened, swollen, and painful. The tongue will be often much enlarged. If the drug is corrosive, sloughs, generally white in colour at first, with a severely inflamed area around them, will be seen; as they fall off they will leave ulcers. Owing to the pain and swelling, it will for some time be impossible to take any food, or at best only that of a soft or fluid nature. Directly drug reaches the stomach intense irritation is set consequently the patient feels severe abdominal pa and generally there is soon violent retching a vomiting. As the poison passes on it produces severe irritant effects on the intestine, and diarrh sets in. Both the vomited matters and the motio often contain blood. The general symptoms are anxious countenance, small feeble pulse, scanty urin a low temperature, and all the symptoms of collaps Later on the gastro-intestinal irritation may severe enough to set up general peritonitis, or gastric ulcer may form, and then there may be ad to the case all the symptoms of gastric ulcer and i sequelæ. The inflammation of the œsophagus ma lead to its contraction. At the post-mortem exa mination, if the patient has died soon after administration of the poison, the stomach will b very red and ecchymosed, with a swollen mucou membrane. Parts of the intestine will be in th same condition. This severe inflammation may, in many places, have led to the formation of sloughs It must be remembered that many gastro-intestina irritants have no action on the mouth. Nicotine i a gastro-intestinal irritant because of its action on the ganglia of the intestinal nerves leading to increased peristalsis and secretion.

5. *Drugs which contract the gastric vessels.*— These are the same as those which have already been enumerated as being generally astringent. They are much more used for the intestine than the stomach, and will therefore be considered in detail presently (p. 99).

6. *Drugs acting on the nerves of the stomach.*— All drugs powerfully irritant to the stomach cause pain in it: those that are only slightly irritant give rise to a sensation of warmth. It is never desired to produce gastric pain.

Gastric sedatives.—These drugs are the same as those which are local sedatives to other parts of the body. Those most used for the stomach are—

(1) **Bismuth carbonate.**
(2) **Bismuth subnitrate.**
(3) **Bismuth salicylate.**
(4) **Opium.**
(5) **Hydrocyanic acid.**
(6) **Carbonic acid.**
(7) **Ice.**
(8) **Belladonna.**
(9) **Hyoscyamus.**
(10) **Stramonium.**

They are employed in the very many painful forms of dyspepsia. All, except perhaps stramonium, are in frequent use.

7. *Drugs acting on the movements of the stomach.* It has been observed that the movements of the stomach increase as the acidity of the contents increases. If it be that the acidity is the cause of the movements, anything which causes an increase of acidity will lead to more powerful movements. Apart from this, strychnine appears directly to stimulate the plain muscle of the gastric wall. Stomachics also probably aid the movements, so that our complete list will be mineral acids, nux vomica, and stomachics.

The proper churning up of the gastric contents is so necessary, that the value in dyspepsia of drugs which aid the gastric movements is very great. Hence the frequency with which nux vomica enters into antidyspeptic acid mixtures.

Carminatives.—This term is often applied to substances which aid the expulsion of gas from the stomach and intestines. They act either by stimulating the gastric and intestinal movements or by so regulating muscular contraction as to diminish spasm. It has been found from clinical observation that the most efficient carminatives are—

(1) **Stomachics** generally, especially—
(2) **Aromatics,**
(3) **Bitters,**
(4) **Pungent substances,**
(5) **Alkalies,**
(6) **Asafetida,**
(7) **Ammoniacum,**
(8) **Valerian,**
(9) **Camphor,** and
(10) **Volatile Oils.**

8. *Emetics.*—It is well known that the many co
plicated mechanisms involved in the act of vomiti
are under the control of a centre in the medul
which is capable of being stimulated by afferent i
pulses reaching it from many sources, such as t
cerebrum, as when sights or smells cause sickness, t
mouth, the pharynx, the œsophagus, the lungs, t
heart, the stomach, the intestines, the biliary pa
sages, the kidney, the peritoneum, and the uterus
so that drugs acting on any of these organs, or c
the centre itself, might be emetics. But it is usua
in describing drugs which cause vomiting, to men
tion only those which do so either by acting on th
stomach or on the centre in the medulla, and the
are divided into two corresponding classes. Thos
acting on the stomach are sometimes called **direc**
emetics, because they act directly on the stomach
and those influencing the medulla are called **indirect**
but some authors reserve the word direct for those
acting on the medulla, and speak of those affecting
the stomach as indirect. Considering this confusion
it is better to divide emetics into gastric and central.
By means of the following experiments we determine
to which group any drug belongs.

(1) The emetic is injected directly into the circulation. If very shortly after this vomiting takes place, the drug must have acted on the medulla, to which it has been carried by the circulation; but if some time elapses we conclude it acted on the stomach, and that it was first excreted into this organ before vomiting took place. This experiment may be made still more striking by injecting directly into the carotid, for then the medulla is quickly reached.

(2) If the least quantity of the drug which, when injected into the circulation, will produce vomiting is larger than is necessary when it is introduced directly into the stomach, the inference is that the

drug acts primarily on the stomach, and that when it produces vomiting after injection into the circulation it only does so because some of it has been excreted into the stomach.

(3) If the drug will not produce vomiting after injection into the circulation when the stomach is replaced by a bladder, it shows that it acted on the stomach; but if vomiting is produced it shows that the drug acted on the medulla, and that the vomiting is caused by the contraction of the abdominal muscles.

(4) If the drug takes a long while to act after its introduction into the stomach, it probably acts centrally; and the reason for the delay is that sufficient time must elapse for the drug to be absorbed.

In spite of these experiments it is difficult to be sure about the action of emetics, for some act in both ways, and some may in the course of their circulation through the blood act upon some of the many parts of the body from which the vomiting centre receives afferent impulses.

The following is a list of those emetics which are commonly used.

(1) **Apomorphine.**
(2) **Tartar emetic.**
(3) **Ipecacuanha.**
(4) **Alum.**
(5) **Ammonium carbonate.**
(6) **Copper sulphate.**
(7) **Zinc sulphate.**
(8) **Sodium chloride.**
(9) **Mustard.**
(10) **Warm water.**

Of these apomorphine is the only one that acts solely centrally. The others all act chiefly on the stomach, but tartar emetic and ipecacuanha probably act partly centrally.

Therapeutics.—Emetics have two uses. Firstly, to remove the contents of the stomach. Thus when that organ is over-full, and there is a feeling of nausea, an emetic by emptying the stomach may relieve. Emetics are largely used to empty the stomach in cases of poisoning, and they may benefit certain

cases of sick headache. An emetic occasionally
the expulsion of a foreign body which has bec
impacted in the fauces or œsophagus. Secon
emetics are used to expel the contents of the
passages, especially in children, for they can
expectorate well. For this purpose these drugs
given to help children to expel the morbid produ
in bronchitis, laryngitis, and diphtheria. They a
aid the expulsion of foreign bodies that have beco
impacted in the larynx. In choosing an emetic
will be remembered that although apomorphi
ipecacuanha, and tartar emetic are the most pow
ful they are the most depressant, and are therefo
not suitable in many cases—such, for instance,
poisoning accompanied by severe collapse. Wh
the poison is a powerful gastro-intestinal irrita
if the condition of the mouth and œsophagus w
allow of it, it is preferable to wash out the stomac
rather than to use an emetic.

Emetics are not permissible for patients sufferi
from aneurysm, hernia, prolapse of the uterus
rectum, peritonitis, or a tendency to hæmorrhag
because of the straining induced by the vomitin
which should make us cautious in giving them t
those who have disease of their vessels or high tensio
in them, for the straining may lead to hæmorrhage.

9. *Antiemetics.*—The causes of vomiting are s
numerous that the number of drugs which may sto
vomiting is very large; therefore, as in the case o
emetics, we can only consider those which act eithe
on the stomach or on the centre in the medulla.

Antiemetics acting on the stomach.—These are all
those substances which have been already enumerated
as having a sedative influence on the gastric nerves,
viz.:

(1) **Ice**, (2) **Bismuth carbonate**, (3) **Bismuth
subnitrate**, (4) **Opium**, (5) **Hydrocyanic acid**, (6) **Carbonic acid**. Also some drugs which occasionally appear to

have a specific local action in arresting vomiting ; such are (7) **Cocaine,** (8) minute doses (1m) of **Vinum Ipecacuanhæ,** (9) minute doses (1m) of weak **Tincture of Iodine,** (10) minute doses of **Arsenious acid,** (11) small doses of each of **Alcohol,** (12) **Carbolic acid,** (13) **Chloroform,** (14) **Creosote,** (15) **Ether,** (16) and **Silver nitrate.**

Antiemetics acting centrally.

(1) **Opium.** (2) **Bromides of Ammonium,** (3) **of Potassium,** and (4) **of Sodium.** (5) **Chloral hydrate.** (6) **Amyl nitrite.** (7) **Nitroglycerin.** (8) **Dilute Hydrocyanic acid.** (9) **Alcohol.** It will be noticed that some drugs fall under both headings.

Therapeutics. The very name of these drugs indicates their therapeutical application. At the best they are only palliative ; the right way to treat vomiting is, if possible, to remove the cause. Of antiemetics, ice, dilute hydrocyanic acid, carbonic acid, bismuth salts, morphine, and iodine are perhaps the most reliable, but all are very uncertain.

D. Drugs acting on the Intestines.—Many secretions are poured into the intestine, the food is much altered by the time it arrives there, and it is changed in its course down the intestine ; the physiology of intestinal digestion, of the movements and the nervous mechanisms of the intestine are imperfectly known ; drugs may be considerably altered by the time they come to this part of the alimentary canal, and its diseases are little understood ; consequently we cannot arrange the action of drugs in a physiological classification. We know, in fact, of only two important divisions, purgatives and astringents.

The methods of experiment which have been used to determine the mode of action of purgatives are chiefly those of Thiry and Moreau. The first-named observer cut the intestine across in two places a short distance apart : the isolated part which was still attached to the mesentery was sewn up at one end ;

the other, the open end, was attached to the abdomi
wall, and thus there was a test-tube-like piece of
testine into which drugs could be placed. The pa
of gut either side of the excised piece were se
together, so that the whole intestine was the sa
as before but a little shorter. This method
not give very satisfactory results, and consequen
Moreau devised his experiments, which seem mo
trustworthy. He put four ligatures round the inte
tine at equal distances apart, so that he shut off fro
the rest of the gut and from each other three pieces
intestine, each the same length. With a fine syrin
he injected into the middle piece the drug to be e
perimented upon, and returned the whole into th
abdominal cavity. In a few hours the animal wa
killed, and the state of the interior of the midd
piece was contrasted with that of the pieces eith
side of it. Before Moreau's experiments there ha
been much discussion as to whether some purga
tives did not act only by increasing the action of th
muscular coat, and others only by stimulating th
secretions, but from these experiments it appear
that the majority act in both ways, some ver
slightly on the secretion and powerfully on th
muscle and others less on the muscle and mor
on the secretion. But probably when purgative
are given in medicinal doses much of the flui
expelled is merely natural intestinal fluid which ha
been hurried through the intestine before it coul
be reabsorbed, and with all purgatives the increased
muscular contraction which is a local effect is the
chief action. It is undecided whether purgatives
can cause increased muscular contraction in parts of
the bowel with which they do not come in contact ;
the emptying of the colon which may follow after
small rectal enemata appears to show they can, but
then the drug may be absorbed from the rectum and
excreted into the colon. Many purgatives (*e.g.* aloin)

act when given subcutaneously; such action is due to excretion into the colon. In many vegetable purgatives the purgative principle is a glucoside. All these purgative glucosides readily yield derivatives of anthraquinone, and it is to these derivatives that purgation is due, *e.g.* they are contained in rhubarb, purgatin, phenolphthalein, senna, cascara, aloes. We will first consider intestinal purgatives, and then intestinal astringents.

Purgatives are divided into the following classes.

Laxatives.—These are substances which slightly increase the action of the bowels chiefly by stimulating their muscular coat.

They are

(1) **Whole meal bread.**
(2) **Honey.**
(3) **Treacle.**
(4) **Most fruits,** especially—
(5) **Tamarinds,**
(6) **Figs,**
(7) **Prunes,** and
(8) **Stewed apples.**
(9) **Manna.**
(10) **Cassia.**
(11) **Sulphur.**
(12) **Magnesia.**
(13) **Olive oil.**
(14) **Castor oil** (small doses).
(15) **Vaseline.**
(16) **Liquid Paraffin.**

These are all of them domestic remedies employed for slight cases of constipation, especially in children; some, as brown bread, fruits, honey, form articles of diet with persons who are liable to constipation. (17) ergot, (18) physostigma, (19) nux vomica, (20) belladonna, (21) hyoscyamus, and (22) stramonium are also laxatives, but are not used except under medical orders. Nux vomica is most valuable; it is probably a direct stimulant to the muscular coat, hardly influencing secretion. It is largely used in cases of chronic constipation, especially when occurring in anæmic persons, or in those in whom, for any reason, it is likely that the intestinal peristalsis is feeble.

Belladonna in small doses increases peristaltic movements because it paralyses the inhibitory fib of the splanchnics, but in moderate doses it co pletely arrests peristaltic movements. It is chie employed for this latter purpose, especially combination with opium. Hyoscyamus acts on t intestines in the same way, and small doses of it a often given with other purgatives to prevent gripin for it gives an orderly rhythm to the irregular co tractions the stronger purgatives produce.

Ergot and physostigma are hardly ever used f their laxative effect.

Simple purgatives. These are rather more powe ful in their action than laxatives. They stimulat peristalsis and also increase secretion. Some of th laxatives, as castor oil and magnesia, when given i large doses become simple purgatives.

The simple purgatives are—

(1) **Aloes.**
(2) **Rhubarb.**
(3) **Cascara Sagrada.**
(4) **Senna.**
(5) **Purgatin.**
(6) **Phenolphthalein.**
(7) **Fel Bovinum.**
(8) **Pituitary Extract.**

It is interesting to observe that the first four all contain and owe their activity to emodin (trioxymethylanthraquinone), rhubarb and senna contain chrysophanic acid (dioxymethylanthraquinone). Purgatin is an anthraquinone derivative, and phenolphthalein has a somewhat similar structure. Hence these drugs are sometimes called anthracene purgatives, for anthraquinone is anthracene in which CO is substituted for one of the CH groups. The indications for each will be given under the individual drug. Pituitary extract acts almost entirely on the muscular coat.

Drastic purgatives, often called cathartics.—These excite greatly increased secretion and peristaltic movements, and if given in large doses cause severe **irritation of the intestine with much secretion** of mucus, great vascular dilatation and even hæmorrhage, severe abdominal pain and collapse, with profuse diarrhœa. The peristaltic contractions are often irregular, and hence there may be much griping pain; therefore it is usual to prescribe hyoscyamus with these drugs, which are in order of potency

(1) **Calomel.**
(2) **Podophyllum.**
(3) **Aloes.**
(4) **Jalap.**
(5) **Scammony.**
(6) **Oleum Terebinthinæ.**
(7) **Colocynth.**
(8) **Croton oil.**
(9) **Kaladana.**
(10) **Turpeth.**

Some, as jalap, are often called **hydragogue**, because of the large amount of secretion they excite.

Therapeutics. Drastic purgatives are employed in obstinate constipation, and also to produce very watery evacuations with the object of removing as much fluid from the body as possible. Hence the frequent use of jalap in Bright's disease.

Saline purgatives. These in hypertonic solution increase the passage of fluid from the tissues into the intestine, and if in hypotonic or isotonic solutions prevent absorption of fluid, so that in any case a large amount of it accumulates in the intestine. The distension due to this accumulation excites active peristalsis, and consequently an easy painless evacuation of the bowels. It follows that if a very concentrated solution is given, much fluid passes into the intestine. Osmosis certainly plays some part in the process, but many believe that it cannot be entirely explained by physical laws, and that there is a selective action on the intestinal epithelium for particular ions; thus as neither ion in magnesium sulphate is easily taken up by the epithelium, the sulphate remains in the bowel to act as an excellent purgative. The action is by many considered to be

entirely local, for no purgation follows if the sa
injected into the blood, but Hertz and his co w
believe the salts are absorbed and act, throu
vessels, directly on the colon as stimulants to
ment and secretion, for they find that none
salt taken reaches the colon by the intestinal
until long after the evacuation produced by th
The saline purgatives are

(1) **Potassium tartrate.**
(2) **Potassium acid tartrate.**
(3) **Potassium sulphate.**
(4) **Sodium sulphate.**
(5) **Sodium tartrate.**
(6) **Sodium citr**
trate.
(7) **Sodium phosph**
(8) **Sulphate and**
salts of m
sium.

Therapeutics. These are very largely us
habitual purgatives, especially for persons suf
from any form of gout. They form the essential i
dient of most purgative mineral waters, as Hu
Janos, Pullna, Friedrichshall, Æsculap, Rubina

The best way of taking them is to pu
required dose of the salt or the mineral water
tumbler, add some lukewarm water, and sip it s
while dressing in the morning.

Cholagogue purgatives will be described
speaking of the liver.

Enemata. Any fluid preparation injected
the rectum is called an enema. When a purgati
liable to produce sickness, or it is unadvisable, bec
of peritonitis, intestinal obstruction, ulceration
other disease, to give it by the mouth, it ma
given by the rectum. Castor oil, aloes, olive
magnesium sulphate, soap, &c., may be administ
in this way. Enough of a vehicle should usuall
given to make a purgative enema up to three qua
of a pint or a pint, for distension of the rectum gre
aids purgation. A teaspoonful of glycerin inje
into the rectum, or one of the Suppositoria Glycer
often unlocks the bowels.

Intestinal Astringents. These may be described under the following heads:

Astringents acting on the vessels of the intestine. These are the same as those acting on vessels generally. Those employed for their action on the intestine are—

(1) **Lead salts.**
(2) Dilute **solutions** of silver salts.
(3) **Alum.**
(4) Dilute **sulphuric acid.**

Astringents coagulating albuminous fluids, and also constricting the vessels:

(1) **Tannic acid,** and all substances containing it, as
(2) **Krameria** root,
(3) **Kino,**
(4) **Hæmatoxylum,**
(5) **Cinnamon,**
(6) **Catechu,**
(7) **Eucalyptus gum,**
(8) **Hamamelis,**
(9) **Acacia Bark,**
(10) **Bael Fruit,**
(11) **Myrobolans,**
(12) **Lead salts,**
(13) **Silver salts,**
(14) **Zinc salts,**
(15) **Bismuth salts,**
(16) **Copper salts,** and especially
(17) **Per-salts of iron.**

Astringents diminishing the amount of intestinal fluid secreted:

(1) **Opium.**
(2) **Lead salts.**
(3) **Calcium salts.**

The precise action of these is obscure, but it is probable that they operate in the way indicated.

Astringents diminishing the contractions of the muscular coat of the intestines:

(1) **Opium.**
(2) **Belladonna.**
(3) **Hyoscyamus.**
(4) **Stramonium.**
(5) **Lead salts.**
(6) **Lime.**
(7) **Bismuth salts.**

Therapeutics. The first proceeding in every case of diarrhœa is to remove its cause; if this can be done, it will probably subside. Often the cause is some irritating, indigestible food, and then it is advisable to give a mild purge, as castor oil or rhubarb, to get rid of it. The majority of cases of ordinary diarrhœa are probably due to some slight enteritis, and then any one of the astringents that have been named will be valuable, for it is desirable to constrict the dilated vessels, and to diminish the secretion and the movements. Intestinal astringents are therefore often combined, and when the diarrhœa is at all serious opium is of great service. If there is a persistent cause, as tuberculous ulceration, the hope of doing good is slight. But the treatment by drugs is only a small part of the battle if the diarrhœa is severe, absolute rest is necessary, food must be very simple and given in very smal quantities at a time, not much fluid should be drunk, and the patient must keep warm.

Intestinal Antiseptics. It is doubtful if it i possible to disinfect the intestinal contents whil they are in the body, and if it were possible it migh be harmful, as intestinal micro-organisms greatl help normal intestinal processes. But the attemp is often made and perhaps with some success whe soured milk (*q. v.*) is given to inhibit the growt of micro-organisms in the large intestine. Th drugs used are the gastric antiseptics (p. 89), lacti acid and calomel. Of these, cyllin and similar coa tar products appear to be the most useful.

E. Drugs acting on the Liver. The liver ha several distinct functions, viz. to secrete bile, to form and store up glycogen, to form urea, to excrete substances absorbed from the intestine, and to destro poisonous substances absorbed from the intestine.

1. *Drugs influencing the secretion of bile.* It doe not follow because more bile appears in the faec that more is secreted, for it may be that the gal bladder and ducts have been thoroughly emptie or that the bile which has been poured into th duodenum has been swept along quickly befo

reabsorption, which is ordinarily brisk, has had time to take place. Drugs which increase the amount of bile actually secreted are called **direct cholagogues**, or **hepatic stimulants**; but this is a bad name, as the liver has so many distinct functions; those which simply lead to a larger amount of bile being found in the faeces without any extra secretion are called indirect cholagogues.

DIRECT CHOLAGOGUES. — Drugs supposed to belong to this group have been studied in fasting curarized dogs, and upon human beings with biliary fistulae. A canula is inserted into the bile duct, and brought out of the body, the drug to be experimented upon is administered, and the amount of bile secreted before and after the administration is noted. No food must be given during the experiment, as that alone causes a considerable increase in the biliary flow.

Direct cholagogue **Bile**.

After bile is given by the mouth it is absorbed, carried to the liver, and there increases the secretion of bile.

The following are by some observers stated to be direct cholagogues, but others state, and probably correctly, that few of them increase the quantity of bile secreted (those believed to be the most powerful are placed first)

(1) **Euonymin.**
(2) **Sodium benzoate.**
(3) **Sodium salicylate.**
(4) **Podophyllum.**
(5) **Iridin.**
(6) **Mercuric chloride.**
(7) **Sodium sulphate.**
(8) **Sodium phosphate.**
(9) **Aloes.**
(10) **Ipecacuanha.**
(11) **Dilute nitric acid.**
(12) **Dilute nitro-hydrochloric acid.**
(13) **Colocynth.**
(14) **Colchicum.**
(15) **Potassium sulphate.**
(16) **Rhubarb.**
(17) **Jalap.**
(18) **Dilute arsenious acid.**

There are individual differences among these drugs; many have no real claim to be called cholagogues, and such as empty the bowels producing a motion full of bile probably do so by hurrying on the contents of the small intestine, and hence they are indirect cholagogues. Some, as sodium salicylate, make the bile very watery; others, as toluylenediamine, which is not given to man, make it so thick that it flows through the duct with the greatest difficulty. Euonymin, sodium benzoate, sodium salicylate, Harrogate old sulphur spring and Carlsbad water are all stated slightly to increase both the total quantity and the solids. Podophyllum and iridin, on the other hand, appear to increase the solids without affecting the quantity.

INDIRECT CHOLAGOGUES. These cause no increase in the amount of bile secreted; they act either by stimulating the upper part of the jejunum and the lower part of the duodenum, thus sweeping the bile on before there is time for it to be reabsorbed; or because the purgative, *e.g.* jalap, or scammony, acts best on the intestine when dissolved in bile, and hence when there is plenty of bile in the intestine it is quickly expelled; or, lastly, because the drug, *e.g.* calomel, is an antiseptic, and so prevents the decomposition of bile by bacteria.

They are (1) **Mercury**, (2) most **Cathartic purgatives**, especially **Calomel**.

Therapeutics. Cholagogues are used for cases of dyspepsia in which there is reason to believe that the liver is the organ at fault, and certainly they often have a very markedly beneficial effect. It is clearly an advantage to combine direct and indirect cholagogues in order to ensure that the bile shall be excreted. As bile itself is a stimulant to the peristaltic movements of the intestine, all cholagogues are purgatives, and form a distinct class of purgatives. In cases of hepatic dyspepsia attention to diet is of the greatest importance, and muscular movements, as riding, rowing, &c., aid in the expulsion of bile from the gall-bladder and ducts.

ANTICHOLAGOGUES.—These are often called hepatic depressants. They decrease the quantity of bile secreted. Calomel, castor oil, magnesium sulphate, opium, and lead acetate have this effect, that it is not sufficiently marked to interfere with their therapeutic use for other purposes, and they are never employed for this action.

2. *Drugs modifying the formation of urea by the Liver.*—It is believed that some of the nitrogenous substances, especially leucin, arriving at the liver, are there converted into urea. The quantity of urea excreted by the urine is increased by phosphorus, arsenic, antimony, ammonium chloride, and iron. Phosphorus may also lead to the appearance in the urine of leucin and tyrosin. There is some evidence that this drug causes an increase of the urea through its action on the liver, for in phosphorus poisoning that organ undergoes extreme fatty degeneration, and jaundice supervenes. Whether the other drugs act through the liver is doubtful. Antimony and arsenic, if given in large doses for a long time, both produce general fatty degeneration. All these substances must be administered in almost poisonous doses in order to increase the urea in the urine, and they are not employed therapeutically for this purpose.

Opium, colchicum, alcohol, and quinine are said to decrease the quantity of urea excreted.

3. *Depressants of the Glycogenic Function.* Phosphorus, arsenic, and antimony diminish and may stop the formation of glycogen by the liver; they also cause fatty degeneration of it. In certain cases of diabetes, opium, morphine, and codeine have a most marked effect in diminishing the quantity of sugar in the urine.

F. Drugs acting on the Pancreas. The secretion of pancreatic juice is excited by acids, hence any of the drugs increasing the gastric juice (p. 85) and mineral acids stimulate it, but alkalies diminish it as they inhibit the gastric flow. Fats excite the pancreatic flow.

Division X. Drugs acting on the Muscular and Nervous Systems.

A. Drugs acting on Muscles. Pharmacologists have devoted much attention to this class of drugs, but as the facts ascertained are not used in medicine, we need not stop to consider them in detail.

Potassium salts locally applied depress muscular action. Veratrine and Barium excite it.

B. Drugs acting on the Peripheral Endings of Motor Nerves. Of the drugs belonging to this group the action of curare has been worked out most fully. If curare is given to an animal, it is found that the muscles will respond to a mechanical stimulus, although they will not contract when the motor nerve is stimulated. If a single muscle be removed from the circulation by ligature of its vessels before the administration of curare, afterwards it will be the only one that will respond to stimulation of its motor nerve. As this was the only muscle of the body that the drug could not reach, and it is the only one not poisoned, the poison clearly acts locally on the muscles; but as the curarized muscle will respond to mechanical stimulation curare must paralyse the motor nerves within the muscle, probably the en plates.

Curare and conium are by far the most important drugs which paralyse motor nerve ends. Therapeutically we never desire to paralyse motor nerve endings.

C. Drugs acting on the Peripheral Endings o Sensory Nerves (other than those of special sense Our knowledge of these is derived almost entirel from observations on man, for it is very difficult t experiment upon animals, as they have such imper fect means of communicating their sensations to us.

Drugs which stimulate the terminations of sensor nerves. These, when applied locally, cause pai

They are the same as the local vascular irritants which have already been enumerated (p. 59); in fact, most of them give rise to pain by causing local inflammation. There is no need to repeat the list.

Therapeutics. Local irritants are chiefly employed for their action on the vessels, but as they are also counter-irritants, their application to the skin, while causing some pain there, will often relieve a deep-seated pain. Although pain is always referred to the periphery, it is appreciated centrally, and therefore peripheral stimulation of nerves, which reflexly excites the heart and respiration, is used to arouse people from unconsciousness, such as that of fainting or opium poisoning. For these purposes the stimulus must be prompt, hence the application of the faradic current to the skin is a good means to employ.

Drugs which depress the terminations of sensory nerves. Of these there are two kinds: those which relieve pain, or **local anodynes**; and those which diminish sensibility, or **local anæsthetics**.

Local Anodynes. These have but slight action unless [illegible] present. They are

(1) **Aconite.**
(2) **Carbolic acid.**
(3) **Menthol.**
(4) **Orthoform.**
(5) **Veratrine.**
(6) **Ether.**
(7) **Alcohol.**
(8) **Chloroform.**
(These last three must be allowed to evaporate.)
(9) **Chloral.**
(10) **Chloretone.**
(11) **Belladonna.**
(12) **Stramonium.**
(13) **Hyoscyamus.**
(14) **Opium.**
(15) **Sodium bicarbonate.**
(16) **Oxide of zinc.**
(17) **Dilute hydrocyanic acid.**

In the above list the most powerful are placed first. Many other substances are said to be local anodynes, but their claim to the title is doubtful. Cold is a powerful depressant of sensibility, and therefore it is an excellent local anodyne; so is warmth, for heat dilates the vessels, and thus relieves tension, which is a very powerful factor in causing pain.

Therapeutics. It is clear that the scope for the employment of local anodynes is very wide. If possible, the first thing is to remove the cause of the pain, but often, as in neuralgia and many forms of pruritus, we cannot do this.

Local Anæsthetics. These are **cocaine, benzamine, carbolic acid, kava root,** and **extreme cold,** whether produced by ice or ethyl or methyl chloride spray. These sprays are not so much employed as formerly to produce local anaesthesia for small operations, because they have been largely superseded by cocaine, which produces a high degree of local insensibility.

D. Drugs acting on the Trunks of Nerves. These are of greater pathological than pharmacological interest. If taken for a long time they produce chronic inflammation of the nerves, which is shown by the great increase of the fibrous tissue between the nerve fibres, and the fatty degeneration of the fibres themselves. During the earlier stages the irritation of the nerves causes much pain and tingling; later, as they lose their function, numbness, with loss of sensation, and paralysis set in, often accompanied by trophic lesions. For fuller details, books on medicine must be consulted.

The drugs producing peripheral neuritis are

(1) **Lead.**
(2) **Alcohol.**
(3) **Arsenic.**
(4) **Mercury.**

E. Drugs acting on the Spinal Cord. The difficulties of experiment are so great that we know nothing of the action of drugs on the sensory portions of the cord. We are also ignorant of the action of drugs on the motor fibres. The following method is adopted to discover whether a drug acts on the anterior cornua. Suppose we are studying a drug which stimulates them. After the drug has been given, a slight peripheral stimulus will produce such marked reflex action that convulsions will ensue upon the stimulation. If the cord is cut across and the convulsions follow the stimulus as before, it is clear that these cannot be of cerebral origin, for in that case they would not take place below the point of section. Again, if before injection of the drug into the circulation the vessels of the cord are ligatured, and then the drug causes no convulsion, it is clear that it acts on the cord and not on the muscles or nerves. These results are confirmed if, when the drug is injected into vessels by which it reaches the cord quickly, convulsions occur sooner than when it is thrown into other vessels; also if convulsions do not take place when the cord is destroyed; and lastly if, when the destruction is gradually caused by pushing a wire down the vertebral canal, the convulsions cease from above downwards as the cord is destroyed. Strychnine has been much more fully studied than any other drug which acts on the cord. The effect of it is to convert what would normally be inhibitory impulses into excitory (see Strychnine).

The drugs increasing the irritability of the anterior cornua are

(1) **Strychnine.**
(2) **Brucine.**
(3) **Ammonia.**
(4) **Thebaine.**
(5) **Chloroform.**
(6) **Ether.**
(7) **Ergot.**
(8) **Opium.**

(The last four only slightly, and early in their action.)

Therapeutics. It is very rarely that we can do any good in spinal diseases by attempting to stimulate the anterior cornua, but strychnine is occasionally given for cases of paralysis due to disease of the spinal cord.

Drugs which depress the activity of the anterior cornua

(1) **Physostigmine.**
(2) **Bromides.**
(3) **Alcohol.**
(4) **Chloroform.**
(5) **Ether.**
(6) **Ergot.**
(7) **Opium.**
(8) **Mercury.**
(9) **Zinc salts.**
(10) **Silver salts.**
(11) **Sodium salts.**
(12) **Potassium salts.**
(13) **Lithium salts.**
(14) **Antimony salts.**
(15) **Arsenical salts.**
(16) **Camphor.**
(17) **Amyl nitrite.**
(18) **Sodium nitrite.**
(19) **Chloral.**
(20) **Carbolic acid.**
(21) **Apomorphine.**
(22) **Veratrine.**
(23) **Turpentine.**
(24) **Saponin.**
(25) **Emetine.**
(26) **Gelsemium.**
(27) **Colchicum.**
(28) **Kava root.**

Of these, apomorphine, alcohol, chloroform, ether, arsenic, camphor, morphine, carbolic acid, chloral, nicotine, and veratrine first excite slightly before depressing.

Therapeutics. These drugs are of very little use in medicine for their action on the spinal cord. Physostigmine is by far the most powerful, and has been occasionally used in obscure nerve diseases accompanied by convulsions, as tetanus.

Ergot has a very peculiar action in producing sclerosis of the posterior columns of the cord. Lead sometimes causes atrophy of the anterior cornual cells, and long-continued abuse of alcohol probably causes slight degeneration of the cord as a whole.

F. Drugs acting on the Brain.—The action o these cannot be localised nearly so accurately as can that of drugs acting on the spinal cord and nerves. Drugs acting on the brain illustrate two very important general laws.

First, the **law of dissolution**, which, when state as it applies in pharmacology, is as follows. Whe a drug affects functions progressively, those firs affected are the highest in development; that is t say, they are the last acquired by the individual an he last to appear in the species. The next affected are those next to highest, and so on; till finally the lowest of all from an evolutionary point of view, that is to say, the functions of respiration and circulation, are affected. This law is very well exemplified in the case of alcohol, for the first functions to be disordered are those of the intellect, especially the highest, such as judgment and reason; then follow disorders of movement, and finally death from failure of respiration and circulation.

Another law very well exemplified by drugs which act on the brain is that when a drug in moderate doses excites a function, in large doses it often paralyses it. For example, a person under the influence of chloroform, soon after its administration, tosses his arms about in a disorderly way, but they subsequently become motionless; and many other cerebral stimulants may also be hypnotics. Some think that drugs excite nervous functions by direct action, others that the excitation is often due to the moval of inhibitory impulses.

Drugs acting on the motor centres of the brain.—To investigate these, the motor area of the cortex is exposed by trephining, and the strength of current which it is necessary to apply to the motor area to produce corresponding movements is noted before and after the administration of the drug. Another method is to observe the strength of current necessary to evoke a movement, then to allow the trephine wound to close, afterwards the animal is made to take the drug regularly for some weeks. The opposite motor area is then exposed, and the strength of current required to call forth movements is noted.

It has been found that

(1) **Alcohol,**	(4) **Potassium bromide,**
(2) **Anæsthetics,**	(5) **Sodium bromide,**
(3) **Chloral,**	(6) **Ammonium bromide,**

diminish the activity of the motor area.

Bromides are largely used in epilepsy and other convulsive disorders on account of this function.

Drugs exciting the motor area of the cortex are

(1) **Atropine.**
(2) **Absinthe.**
(3) **Strychnine.**
(4) **Physostigmine.**

They have no therapeutical application in virtue of this property.

General cerebral stimulants. It is impossible to know anything of these by experiments on animals. In man they cause general excitation of the mental faculties, followed in many cases by delirium and incoherence. The exact form of delirium differs a little in each case.

Such drugs are

(1) **Belladonna.**
(2) **Stramonium.**
(3) **Hyoscyamus.**
(4) **Alcohol.**
(5) **Chloroform.**
(6) **Ether.**
(7) **Nitrous oxide.**
(8) **Coffee.**
(9) **Tea.**
(10) **Guarana.**
(11) **Cocaine.**
(12) **Cannabis indica.**
(13) **Opium.**
(14) **Camphor.**
(15) **Santonin.**
(16) **Quinine.**
(17) **Salicylic acid.**
(18) **Tobacco.**

Therapeutics. Many of these are taken habitually as cerebral stimulants; for example, alcohol, tea, coffee, tobacco, in England; opium in the East; cannabis indica in many parts of Asia; coca in parts of South America; and if it is wished to give a cerebral stimulant as a drug, one of these is usually chosen. The rest, which are very important, are commonly employed for some other action. With very many of this class of drugs, as will be seen directly, the stimulant action soon gives way to a paralysing influence.

General cerebral depressants.—These are commonly divided into three classes: Hypnotics or Soporifics, Narcotics, and Anæsthetics. It is believed that one way at least in which any drug depresses the activity of a neurone is by causing retraction of the terminal filaments of its dendrons or axon, thus rendering synapses less intimate. During depression of activity the brain is anæmic, but this is the result more than the cause of the depression.

HYPNOTICS OR SOPORIFICS are drugs which produce sleep, closely resembling, if not identical with, natural sleep.

The hypnotics are—

(1) **Opium.**
(2) **Morphine.**
(3) **Chloral hydrate.**
(4) **Butyl-chloral-hydrate.**
(5) **Bromides.**
(6) **Chloral formamide.**
(7) **Chloralose.**
(8) **Chloretone.**
(9) **Sulphonal.**
(10) **Paraldehyde.**
(11) **Methylsulphonal.**
(12) **Barbitone.**
(13) **Medinal.**
(14) **Adalin.**
(15) **Alcohol.**
(16) **Hyoscine.**
(17) **Cannabis indica.**

Therapeutics. These drugs are often used for persons suffering from sleeplessness, but it is far more important to remove the cause of the sleeplessness. Sleep is often promoted by dilating the vessels of other parts of the body than the brain; for example, a warm bath or an abundant meal conduces to sleep. The use of hypnotics is greatly abused. Those who take them become habituated to them so that at last even large doses do not cause sleep. In general, the bromides, methylsulphonal, and chloral formamide are perhaps the most satisfactory.

NARCOTICS are substances which not only produce sleep, but also in large doses depress the functions of respiration and circulation. Many of them fall also under the head of general anæsthetics; others are, in smaller doses, hypnotics. It has been suggested by Meyer and Overton that as many of these substances, *e.g.* ether, sulphonal, methylsulphonal, chloroform, chloral, and chloral formamide, are more soluble in lecithin and cholesterin than in water, they will accumulate in the nervous system, where these substances are chiefly present, and that this helps to explain the action of these drugs. This may be so, but many hypnotics, *e.g.* bromides, are not specially soluble in lecithin or cholesterin, and many substances are soluble in lecithin and cholesterin but are not hypnotics, so this question of solubility cannot be the whole explanation.

The following is a list of narcotics:

(1) **General anæsthetics.**
(2) **Opium.**
(3) **Chloral hydrate.**
(4) **Belladonna.**
(5) **Stramonium.**
(6) **Hyoscyamus.**
(7) **Alcohol.**
(8) **Cannabis indica.**

All must be given in considerable doses.

Therapeutics. They are of great use in calming excitement of any kind; many of them, such as, for example, opium and belladonna, are beneficial in relieving distress and producing sleep in heart disease.

General Anæsthetics.—These are drugs that lead to a total loss of consciousness, so that pain is no longer felt; at the same time reflex action is abolished. They illustrate admirably the law of dissolution, and also the fact that after excitement paralysis often succeeds; and the stages consequent upon these laws can be readily observed in any one who is taking an anæsthetic. Firstly, in obedience to the law of dissolution the highest faculty, the imagination, becomes excited, the patient sees visions and hears noises. He next begins to chatter wildly and incoherently, for in the excitement of any function by a drug the exaltation is usually irregular, and confusion results. Next, the other motor centres of the cortex are stimulated irregularly.

that he gesticulates, throws his arms about wildly, and tosses his body. By this time the brief stimulation of the higher intellectual faculties has probably passed, and in obedience to the second law vision, hearing, and touch are dulled, and he has lost control over his reason, so that he feels light headed, as he expresses it, crying and laughing easily; now he is really irresponsible for his actions and careless as to their results. It will be noticed that the functions are paralysed in the order stated in the law of dissolution. Next there follows upon the stimulation of the motor areas stimulation of the heart and respiration. The pulse and respirations both increase in number, the blood pressure rises, the face flushes. Then comes depression of all the functions previously excited; first the higher parts of the cerebrum give way, and the patient loses consciousness; neither sights, sounds, nor painful impressions rouse him; he becomes quiet, and ceases to throw his arms and legs about; the reflexes disappear, and consequently touching the conjunctiva does not produce closing of the eyelid; the feet do not move when they are tickled, the pupil is contracted, and the previous quickening of the pulse and respiration is succeeded by slowing of their rate. It is at this period that the patient cannot feel pain, and that therefore operations are performed. The depression of the motor centres is followed by the depression of the muscular tone, and the muscles become quite flaccid and cease to respond to mechanical stimulation. This is the degree of narcosis that is required for the easy reduction of dislocations and for the easy manual examination of the abdominal viscera. Anaesthetics should not be pushed beyond this stage. If they are, even the involuntary muscles lose their tone and reflex excitability, so that the sphincters of the rectum and the bladder relax. The depression of the pulse and respiration continues, the move ments of the chest become weaker and weaker and slower and slower, the pulse becomes very feeble, slow, and irregular, and the heart finally stops in diastole. Death occurs partly by the heart and partly by the respiration. At any period of the administration during which recovery is possible, the functions of the body will return in just the reverse order to that in which they were lost, thus again illustrating the law of dissolution. It is often many hours before the mental faculties have recovered their equilibrium, and long after the patient can move his muscles he cannot co-ordinate them. There are individual differences in the different anæsthetics and in different persons.

The general anæsthetics are

(1) **Chloroform.**
(2) **Ether.**
(3) **Nitrous oxide.**
(4) **Many other substitution products** derived from alcohol and ethers.

Therapeutics. Anæsthetics are given to cause unconsciousness, so that pain may not be experienced during operations, to relax muscles in cases of dislocations, abdominal examinations, or phantom tumours, to relieve severe pain, such as that of parturition, biliary and renal colic, to quiet the body during convulsions, as in tetanus and hydrophobia.

The chief dangers of anæsthetics are—1. Death from shock. This usually takes place before the patient is fully under the influence of the anæsthetic, reflex action is not yet quite abolished, and the heart is stopped reflexly from the peripheral stimulus of the operation. This is one of the greatest and most common dangers of anæsthetics, especially chloroform. It is, to a large extent, avoidable if care be taken that the patient is fully under the influence of the anæsthetic before the operation is begun; occasionally when it is trivial the operator in too great a hurry to begin, and the patient suddenly dies from failure of the heart.

2. Death from paralysis of respiration. This is usually due to a combination of circumstances. Too much of the anæsthetic may have been given. Respiration may be difficult because the patient suffers from some disease of the lungs, or the operation may demand that he should lie on his side or in some other position which hampers respiration. This is not a very great danger, for it is heralded by lividity; and if then the posture is changed, the administration of the anæsthetic is stopped and artificial respiration is performed, the patient usually quickly recovers; even if he does not, artificial respiration with the head thrown back and the tongue pulled out should be carried on as long as there is any evidence that the heart is beating, or if the patient draws a breath when artificial respiration is stopped for half a minute. Cases have recovered although it has been necessary to keep up artificial respiration for hours.

3. Cardiac failure may occur, owing to sudden action on the vagal centre, if the vapour is too concentrated. The patient almost suddenly becomes pale, and the pulse stops. In such a case no more anæsthetic must be given, artificial respiration must be kept up in the manner just mentioned, and the heart may be stimulated by the subcutaneous injection of brandy, by the inhalation of amyl nitrite, by the application of the faradic current over the cardiac region, by the plunging of electric needles into the heart, or by flicking the chest over the heart with hot towels and placing hot compresses over it. The feet should be raised and the head depressed.

4. Vomited matter and, if the operation is about the mouth, blood may suffocate the patient. To avoid the first contingency no food should be taken for some time before the operation, and if the patient is sick he should be turned on his side; to avoid the

second special precautions must be taken, which are described in books on operative surgery.

5. Reduction of body temperature due to diminished activity and to vasodilatation of the vessels of the skin. This is minimised by keeping the surroundings of the patient as warm as possible durin the operation, and by the use of hot blankets and h bottles afterwards.

For the relative advantages of the different ana thetics and the mode of giving each, the accounts of the individual drugs must be consulted.

G. Drugs acting on the Eye.

1. **Drugs acting on the Pupil.** The first thing to determine is whether any drug which dilate or contracts the pupil acts locally or centrally. It is dropped into one eye: if it only acts feebly and after some time and on both eyes, it follows that it has acted centrally after absorption from the conjunctiva into the general circulation; but if it acts quickly, powerfully, and only on the eye into which it was dropped, its action is local. If it acts on an excised eye its action must be local. If, when all the vessels going to the eye are ligatured, the drug wil act when dropped into the eye, but will not when thrown into the general circulation, this again show that its action is local, and that when it acts aft being thrown into the circulation when no vessels ar ligatured it does so because it is circulating locall through the eye. If all the arteries and veins o the eye are ligatured, and the drug will not act whe locally applied, although it would before, and wi now when thrown into the general circulation, shows that its action is central, and that it acts whe dropped into the eye because some of it is absorbed.

If it has been proved by these means to a centrally the further investigation is difficult, for th central mechanism is complex

If it has been proved to act locally, it may act either on the muscular fibres of the iris, on the terminations of the third nerve in them, or on the terminations of the cervical sympathetic in them. Stimulation of the third nerve causes the pupil to contract; section of it causes the pupil to dilate. Stimulation of the sympathetic causes the pupil to dilate; section of it causes the pupil to contract. If the pupil is dilated by the local action of a drug, and stimulation of the third nerve will not cause it to contract, but yet the muscle is responsive to mechanical stimulation, it shows that the endings of the third nerve are paralysed. If the pupil is contracted by a drug, and although responsive to mechanical stimulation, will not dilate when the third nerve is cut, it shows that the ends of the third nerve are stimulated. If a drug locally dilates the pupil, but not as powerfully as stimulation of the sympathetic, it is clear that its whole effect is not due to a stimulation of the sympathetic; and if the muscle remains locally irritable, the third nerve ending must be paralysed. A series of similar experiments may be made with regard to the sympathetic. By these means the mode of action of many drugs has been made out, but often they act both on the sympathetic and the third nerve. In the following list they will be classified under their main actions.

Mydriatics (pupil dilators)

A. *Paralyse the terminations of the third nerve.*

(1) **Atropine.**
(2) **Homatropine.**
(3) **Euphthalmine.**
(4) **Hyoscyamine.**
(5) **Coniine.**
(6) **Gelsemine.**
(7) **Muscarine.**
(8) **Hydrocyanic acid.**
(9) **Aconite.**
(10) **Amyl nitrite.**

It is not quite certain how the last five act, but probably on the ends of the third nerve.

B. *Stimulate the terminations of the sympathetic.*

Cocaine.

C. *Act centrally.* **Anæsthetics** (late in their action).

Myotics contract the pupil.

A. Stimulate the terminations of the third nerve. **Pilocarpine, nicotine** (probably).

B. Stimulate the muscle. **Physostigmine.**

C. Act centrally. **Anæsthetics** (early in their action) **opium.**

Therapeutics. Dilators of the pupils, especially atropine and homatropine, are used to dilate the pupil for ophthalmoscopic examination, and to prevent or break down adhesions of the iris. Contractors of the pupil, especially physostigmine, are used to overcome the effects of atropine, and to prevent too much light entering the eye in painful diseases of it.

2. **Drugs acting on the Ciliary Muscle.** The following drugs impair or paralyse accommodation :

(1) **Atropine.**
(2) **Hyoscyamine.**
(3) **Homatropine.**
(4) **Cocaine.**
(5) **Physostigmine.**
(6) **Pilocarpine.**
(7) **Gelsemine.**
(8) **Coniine.**

Intra-ocular tension is increased by atropine (large doses), hyoscyamine, daturine. It is decreased by cocaine, hyoscine, and physostigmine.

Gelsemine paralyses the external ocular muscles, especially the levator palpebræ and the external rectus, by its action on the terminal nerve filaments.

Cocaine stimulating the unstriped fibres in the orbital membrane and the eyelids causes the eye to protrude.

Coniine produces ptosis.

The capacity for seeing blue is increased by strychnine. Santonine causes first violet, then yellow vision.

H. Drugs acting on the Ears.—We know very little about the action of drugs on these. Quinine and salicylic acid cause noises and buzzing.

I. Drugs acting on Sympathetic System. The fact has been made out that if an animal be poisoned with a large dose of nicotine, or if this be painted locally on the superior cervical or other peripheral nervous ganglia, stimulation of the nerve fibres below the ganglion no longer produces its characteristic effects, *e.g.* constriction of the ear vessels, dilatation of the pupil, secretion of saliva, although stimulation above the ganglion does. The ganglion cells are clearly paralysed. A small dose at first stimulates them. Curare, lobelia, and coniine have the same effect on ganglia, and so produce effects on the heart, vessels, and secretions which have been described on pp. 57, 62, and 83. Sphacelinic acid stimulates sympathetic ganglia and is thus antagonistic to nicotine.

Division VI. Drugs acting on the Organs of Generation.

A. Aphrodisiacs. These are substances which increase sexual desire. There are conceivably many ways in which this might take place. There is a centre in the lumbar spinal cord, irritation of which causes erection, and this is capable of being excited by afferent impulses proceeding from many parts of the body, but especially from the cerebrum, and the genital organs themselves, or the parts in their immediate neighbourhood. The lumbar centre appears to be very dependent upon the general health, and therefore substances which improve this are indirectly aphrodisiacs.

The following drugs have been used as aphrodisiacs; their mode of action is not certainly known.

(1) **Strychnine.**
(2) **Cantharidin.**
(3) **Alcohol.**
(4) **Cannabis indica.**
(5) **Camphor.**
(6) **Phosphorus.**
(7) **Damiana.**

B. Anaphrodisiacs. We do not know for certain of any drugs which have a depressant effect upon the lumbar centre. Most anaphrodisiacs act by decreasing or removing some irritation which is reflexly producing an aphrodisiac effect, but some probably act centrally.

Drugs used as anaphrodisiacs are

(1) **Bromides.**
(2) **Iodides.**
(3) **Opium.**
(4) **Belladonna.**
(5) **Hyoscyamus.**
(6) **Stramonium.**
(7) **Digitalis.**
(8) **Purgatives.**

C. Ecbolics or **Oxytocics** are remedies which during or immediately after parturition increase uterine action.

They are

(1) **Ergot.**
(2) **Pituitary Extract.**
(3) **Quinine.**
(4) **Hydrastis.**
(5) **Savin** (B. P. 1885).
(6) **Rue** (B. P. 1885)
(7) **Powerful purgatives.**
(8) **Suprarenal Extract.**
(9) **Cotton Root Bark.**

Of these ergot and pituitary are by far the most important. Occasionally some of these drugs will act upon the gravid uterus to produce abortion before parturition has begun. They have almost all been used criminally for this purpose.

D. Emmenagogues are substances used to increase the menstrual flow. Diminution of the menstrual flow is a symptom of so many diseases that a large number of drugs which remedy these are indirect emmenagogues, but the substances which seem to have a special action in increasing the menstrual flow are

(1) **All Ecbolics.**
(2) **Asafetida.**
(3) **Myrrh.**
(4) **Guaiacum.**
(5) **Cantharidin.**
(6) **Borax.**

Among the many indirect emmenagogues the commoner are purgatives, iron, manganese, cod-liver oil, and strychnine.

n act by improving the general health. Hot foot or hip baths, especially if mustard be added, often aid the onset of menstruation.

E. Substances which depress Uterine Action.—

These are employed to restrain the contractions of the gravid uterus. They are:

(1) **Bromides.**
(2) **Opium.**
(3) **Chloral.**
(4) **Cannabis indica.**
(5) **Chloroform.**
(6) **Tartarated antimony.**

F. Drugs acting on the Secretion of Milk.

Galactagogues, or drugs which increase the secretion of milk.

Pituitary Extract, **Pilocarpin**, and **Alcohol**. Of these the first two are the most powerful, but the effects soon pass off. Alcohol is very feeble. The secretion is so much under the control of the general health that the best way to secure an abundant secretion is to keep the general health as good as possible.

Antigalactagogues, or drugs which decrease the secretion of milk.

Belladonna, either given internally or applied locally as a liniment, probably acts locally on the mammary gland as on the sweat glands.

The following *drugs*, if given, are *excreted in the milk*, and are therefore taken in by the child: Oil of anise, oil of [illegible], oil of turpentine, oil of copaiba, and probably all the oils, sulphur, rhubarb, senna, jalap, scammony, castor oil, opium, iodine, indigo, antimony, arsenic, bismuth, iron, mercury, zinc, potassium iodide. It is clear that these must be administered with care to the mother; for example, oil of turpentine will make the milk so nasty that the child will not take it. The above purgatives given to the mother may cause diarrhœa in the child. Opium should not be given in large doses to the mother. On the other hand, mercury, arsenic, and potassium iodide may be administered to the child by being given to the mother. Salvarsan given to the mother will cure syphilis in the suckling child.

Division XII. Drugs acting on Metabolism

Our knowledge of the normal metabolism of th body is very imperfect, consequently we know ver little more than has been already stated under othe divisions, about the action of drugs on metabolism Any further remarks which are necessary will made when the individual drugs are considered. Tw words in common use are alterative and tonic.

Alterative is a vague term of which no satisfactory defin tion can be given. It is often used to cloak our ignorance, wh we have no exact knowledge of the mode of action of a dr Many drugs comprehended under this term have the propert of profoundly altering the body, especially if it be diseased; f example, mercury will, if the patient be suffering from syphili generally cause the absorption of syphilitic exudations. Al that can be said about such drugs will be stated under each for their mode of action is probably so different that no usefu purpose would be served by considering them together.

Tonic. This is a term usually even more vague than alterative. As commonly employed, it means a drug whic makes the patient feel in more robust health than he di before he took it. Obviously this may happen in many way such as, for instance, by improving the digestion or the quality of the blood. The word tonic is used justifiably when applied to a drug which increases muscular tone.

MATERIA MEDICA.

(All the substances about to be described are pharmacopœia unless the contrary is stated.)

PART I. INORGANIC MATERIA MEDICA.

GROUP I.

Water, Peroxide of Hydrogen, and Oxygen.

AQUA DESTILLATA.

Distilled water, H_2O.

SOURCE.—Prepared by distillation from good natural [illegible] water.

TESTS. Colourless, odourless, and tasteless. 100 millilitres evaporated to dryness leave not more than 0·005 grm. of residue. It is not affected by tests for metals, chlorides, nitrates, nitrites, or sulphates. Tested with sulphuric acid and potassium permanganate, it should show faintest traces of organic matter, and tested with Nessler's test it should only show the faintest traces of ammonia. Aqua destillata is always to be used for making up prescriptions.

ACTION.[*]

External. An indifferent bath (88°–98° F. or about 32°–37°C.), or one in which the bather feels neither hot nor cold, produces no particular effect.

Cold baths increase the production of heat, and abstract heat from the body if they are prolonged; therefore at first the bodily temperature may rise slightly, but when the loss exceeds the production it falls. The amount of carbonic acid expired is increased. The rate of the pulse and respirati at first rises, but soon falls. The skin becom pale, and the condition of goose-skin is seen. Aft the bath (the duration and temperature suitable f different persons vary widely) there is a feeling warmth and exhilaration, and the cutaneous vesse dilate.

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[*] Unless otherwise stated, the word action will in this book always be taken to mean physiological action, or action in health.

A warm bath if sufficiently prolonged may cau a slight rise of the bodily temperature, the sk becomes red, the pulse and respirations are mo frequent, the amount of urine secreted is diminishe and after the bath there is profuse perspiration.

Internal.—Warm water gives rise to nausea an vomiting. Water is very slowly absorbed from th stomach, but quickly from the bowels, and very soo afterwards the amount of urine secreted is greatl increased, and to a less degree the amount of bil pancreatic juice, and saliva. Moderate quantities water promote the flow of gastric juice, but larg amounts should not be drunk during meal times, a that impairs digestion. If a considerable amount water is drunk daily the amount of urinary nitroge excreted is increased. Water not only washes ou the tissues, but renders tissue metamorphosis mor complete.

The action of water will be physically modifie by the substances in solution in it, for there will b no physical interchange between isotonic solutions But water passes from a hypotonic to a hypertoni solution, *e.g.* when red blood corpuscles are place in a salt solution of such concentration that fluid pass from the corpuscles to it they shrink; but whe they are placed in a weaker solution of such strengt that fluid passes from the solution to them the swell. In the first case the salt solution is calle hypertonic, in the second hypotonic as regards th corpuscles.

THERAPEUTICS.

External. *Cold baths* are used for the subsequent invigorating effects, which may be increased by quick rubbing with a rough towel. Persons in whom a feeling of warmth does not immediately follow a cold bath should not use them. The constant daily use of a cold bath probably diminishes the liability to catch cold. Cold baths are said to arrest attacks of laryngismus stridulus. They have been largely used to reduce the temperature in fever, especially typhoid fever. The first effect of putting the patient in the cold water is to cause, reflexly from the stimulation of the skin by the cold, an increased production of heat; for this reason and because of the cessation of radiation, the rectal temperature at first rises a little, but soon, owing to the direct abstraction of heat, and to the diminished production of heat which quickly sets in, it falls rapidly, and continues to do so after the patient is taken out. The temperature of a bath for a patient with typhoid fever should be between 68° and 58° F. (20° and 14° C.); he should be lowered into it by a sheet, and remain in ten minutes, unless before that time he shows signs of collapse; he is then lifted back to bed, where a blanket is thrown loosely over him. If this treatment is adopted the bath ought usually to be given whenever the axillary temperature is 103° F. (39·5° C.). Sometimes the patient is placed in a bath at a temperature 10° F. (5° to 6° C.) below his own, and the water is cooled by putting in cold water or ice, till it has fallen to about 68° F. (20° C.), when he is taken out. Often instead of having a bath he is sponged with cold water as he lies in bed; this saves trouble, but both sponging and a cold pack which consists of a sheet four folds thick wrung out in cold water and wrapped round the naked body for five or ten minutes) are inferior to bath. **Pneumonia** may be treated by the app cation of cold, generally by means of ice poultic applied to the chest. To make an ice poultice, put on piece of gutta percha tissue a layer of wood wool, the one of powdered ice sprinkled with a little salt, tur over the edge of the gutta percha which has bee left wide enough so as to cover in the poultice, an seal the edges with a little chloroform or turpentin Put the poultice in a flannel bag, and bind it on th body where desired, with lint between it and the skin The immediate application of cold baths is by fa the best treatment for any sudden **hyperpyrexia**.

Cold is applied **locally** either by cold water Leiter's coils or ice bags, in a number of conditio with the object of arresting inflammation. Thu ice bags are put on the head in meningitis, or con cussion, and on the knee joint for acute synovitis &c. According to most authorities cold contract not only the vessels of the skin to which it i applied, but by reflex action those of the organ underneath it. Hence the application of an ice ba to the chest to arrest pulmonary hæmorrhage. Col locally applied is therefore **hæmostatic**.

Warm baths, as they liquefy the fatty secretions are more cleansing than cold. Hot baths, like any other application of heat, **soothe pain**, hence they are useful for rheumatoid arthritis and colic, whether renal, biliary, or intestinal. By bringing blood t the skin, and lessening the amount in the internal organs, they **relieve muscular spasm**, such as we find in stricture of the urethra, colic, laryngismus stridulus, other forms of laryngeal spasm, and infantile convulsions. In the same way they are of service in weariness from muscular or cerebral activity, and are useful in many inflammatory affections, as, for example, a cold in the head. A warm bath immediately before going to bed may sometimes cure omnia. The subsequent **increased perspiration** es hot baths and hot packs of great value in the ous forms of nephritis and in uræmia. Great care t be taken after a hot bath which has been given induce sweating to see that the patient is kept m by being wrapped quickly in a hot blanket and into a warm bed; if not, the cutaneous vessels contract, and there is no diaphoresis. A local bath has the same effects, but to a less degree. t foot bath is often used for a cold in the head, for amenorrhœa. Sponging with hot water will, the vascular dilatation and sweating it causes, luce the temperature slightly in fever.

A cold bath is one the temperature of which is w 70° F. (21° C.), one between 88° and 98° F. 2 and 37 C.) is properly speaking indifferent, but often called a warm bath. A tepid bath is rmediate between warm and cold. Anything ve 98° F. (37 C.) is a hot bath. Few people can r a temperature much over 102° F. (39° C.).

Internal. The chief therapeutic use of water is ash out the tissues, especially the kidneys, and ep the urine dilute. Some persons who are liable formation of **gravel** or urinary calculi can by ing plenty of pure water prevent their formafor the minute collections of crystals which are eginning of all calculi are washed out of the ry system before they have time to grow to any , and if they are composed of uric acid the copious nking of water diminishes the liability of their ation, for it decreases the amount of uric acid reted. It is stated that the liability to the formaof gall stones may also be kept in check by the king of plenty of water, as then the bile becomes concentrated and flows more quickly. When quantities of water are drunk it should usually pure distilled water, and should be taken between meals. A glass of cold water taken on rising in the morning will with some persons cause the bowels to be opened. Warm water is an emetic.*

LIQUOR HYDROGENII PEROXIDI.

An aqueous solution of Peroxide of Hydrogen, H_2O_2.

SOURCE.—Prepared by the interaction of water, barium peroxide, and a dilute mineral acid at a temperature below 10

TESTS. When tested it should yield between nine and eleven times its volume of oxygen, but it is often met with yielding 20 or 30 volumes.

CHARACTERS. Colourless, odourless liquid; slightly acid taste. Renders the saliva frothy.

Dose, ½ to 2 fl. dr. 2 to 8 mils.

USES.

As it easily parts with oxygen it is a powerful disinfectant (it is the active ingredient of Sanitas), and may be applied to ulcers and used as a mouth wash as a 1 in 8 solution. Its disadvantage is its instability. It bleaches and is used as a hair dye. Internally it has been recommended for many diseases, especially diabetes, epilepsy, and uræmia, but there is no proof of its efficacy. It is dangerous if given subcutaneously, or used to wash out serous cavities, for it is quickly decomposed; and if more oxygen is formed than the blood can dispose of, gas emboli are produced, and these, lodging in the lungs or brain, may cause death.

OXYGEN. (Not official.)

Compressed oxygen gas is sold in cylinders containing 12 or 20 cubic feet. A rubber tube with an inhaler at the end can be attached. In the course of the tube sometimes there is a large rubber bag to prevent the compressed oxygen issuing from the inhaler with too great force. Usually far too little oxygen is given and the inhaler is not kept long enough or close enough to the patient's mouth and nose.

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* It is impossible in this book to give more than a brief sketch of baths and the drinking of water and mineral waters. Further information will be found in works on 'General Therapeutics.'

ACTION AND THERAPEUTICS

Oxygen inhalations are used in pneumonia, bron heart disease, convulsions, and any other n accompanied by great lividity. This they often relieve, and they may help a patient to tide temporary risk of death from asphyxia, and if they fail to avert death, they often render the less distressing. They make the pulse slower should be allowed to issue in a gentle stream comes out of the cylinder very cold, the tube ng it should be surrounded by hot water if ent complains that the gas irritates him. Often ie to bubble through a little strong brandy water placed in the bottom of a large bottle. planation of the benefit in the above disease that the blood absorbs more than the normal of oxygen, but that, owing to impeded re n, the air stagnates in the alveoli, and the tion of oxygen leads to the quick diffusion of alveoli, and hence the normal amount can rbed. That taken in solution in the plasma is lly valuable, for it is readily given to the tissues.

GROUP II.

THE ALKALINE METALS.

Potassium, Sodium, Ammonium, Lithium.

POTASSIUM.

Symbol, K. Atomic weight 39·10. (Not official.)

When taken by the mouth, potassium salts are excreted ily as they are absorbed, so no effect is produced by the on, but this is really powerfully depressant to all and muscle tissue, as is shown by local application or bcutaneous injection, in which case excretion is not rapid as absorption.

1. Liquor Potassæ. Solution of Caustic Pota
KHO

SOURCE.—An aqueous solution of potassium carbon
is boiled with slaked lime. The supernatant liquid is sypho
off. $K_2CO_3 + Ca(OH)_2 = CaCO_3 + 2KHO$.

CHARACTERS. A colourless alkaline fluid with a soapy f
and taste. Sp. gr. 1·045. To be kept in green glass bott
with air-tight stoppers.

STRENGTH. 5 per cent., 5 gr. in 110♏. 5 grm. in 1
millilitres of potassium hydroxide in water

IMPURITIES. Carbonic acid, lime, sulphates, chlori
and alumina.

INCOMPATIBLES.—Acids, acid salts, metallic salts a
preparations of ammonia, belladonna, hyoscyamus and st
monium, the alkaloids of these three being decomposed
Caustic Potash. All alkaloids are precipitated by alkalies

Dose, 10 to 30 m. 6 to 18 decimils freely dilut

2. Potassa Caustica. Caustic Potash. Pot
ium Hydroxide. KHO. *Synonym.* Potassæ hydras.

SOURCE.—Obtained by the interaction of potassi
carbonate and calcium hydroxide. It contains not less th
85 per cent. of pure potassium hydroxide.

CHARACTERS.—Hard, deliquescent, corrosive white penc

IMPURITIES.—The same as of liquor potassæ

ACTION OF POTASH.

External. It is, if concentrated, a power
irritant and **caustic**, acting by abstracting wat
from the part to which it is applied. It dissol
fatty matters that may be present on the surfa
It is **antacid**, and, if freely diluted, **sedative**.

Internal.—*Mouth.*—Alkalies have a soapy tas
and if sufficiently concentrated irritate the mou
making the mucous membrane red.

Stomach. Alkalies in medicinal doses only i
hibit gastric secretion. The effect of large doses
described under the heading of toxicology (see p. 14
If they are given after a meal the gastric juice alrea

reted is **neutralized.** Being readily diffusible lies are quickly absorbed.

Intestine.—Alkalies lead to a diminution of creatic secretion, as they neutralize the acid gastric e which excites pancreatic secretion.

Blood.—This is rendered very slightly more line. All alkalies circulate in the blood as bicarbonates and phosphates. Their action as alkas of the blood is very transitory, for they are kly excreted. The amount of hæmoglobin, if it deficient, is said to be increased. The continual of alkalies diminishes the quantity of fat.

Heart.—Very large amounts of potassium salts **depressant** to all muscular tissues, and therefore ease the force of the heart, ultimately causing stolic arrest by direct action on the cardiac cle.

Kidneys.—Alkaline potassium salts are **diuretic** ng directly on the renal epithelium. They are kly excreted in the **urine**, rendering it **alkaline**, us increasing its power of holding uric acid in ution.

Respiratory passages.—The bronchial secretion is ally **increased** in quantity, and it is rendered viscid, but with some cases of bronchitis it is nished.

Muscle.—The prolonged contraction produced by trine or barium salts is abolished by potassium. They are direct muscular depressants, and also the nervous system, especially the brain pinal cord.

Metabolism.—Potassium salts, like all alkalies, en in large doses, probably increase metabolism, ing to a greater oxidation of proteids and fats. outside the body alkalies frequently promote lation. As a rule the excretion of urea is increased, that of ammonia diminished, but the total gen is increased.

THERAPEUTICS OF POTASH.

External. Caustic potash has been used to de
stroy lupus, and it was formerly employed to mak
issues. Care must be taken to limit its action, for it di
fuses very rapidly. Liquor potassæ is used to dissolv
off the fatty matters, and thoroughly cleanse the ski
before operations, and weaker solutions of it ar
employed to remove the epidermis in certain chroni
skin diseases. A 40-per-cent. solution is recommende
to remove an in-growing toe nail, which is painte
with the fluid, and in a few seconds is so softene
that much can be scraped off. The procedure i
repeated till the nail that remains is sufficiently thi
to be removed with a pair of fine scissors. Dilut
solutions, acting as sedatives, relieve itching.

Internal. -To obtain the effects of alkalies upo
internal organs the bicarbonate, citrate, and acetat
of potassium are preferable to potash, for that is ap
to irritate the stomach, but it is occasionally use
in small doses as a gastric sedative for dyspepsia.

Toxicology, see *Soda* (p. 144).

3. Potassii Carbonas. Potassium Carbonat
K_2CO_3. *Synonym.* Salt of tartar.

SOURCE. Obtained by the interaction of potassiu
sulphate and calcium carbonate.

CHARACTERS. A white, very deliquescent, crystallin
powder with a caustic taste, soluble in its own weight of wate
insoluble in alcohol. Contains not less than 81·5 per cen
of pure potassium carbonate.

Twenty grains neutralize 17 *grains of citric acid* o
18 *grains of tartaric acid.*

IMPURITIES. Sulphates, chlorides.

It is used in preparing Liquor Arsenicalis (as a solvent
Decoctum Aloes Compositum (to dissolve the resin), an
Mistura Ferri Composita (carbonate of iron is formed).

Dose, 5 to 20 gr.—3 to 12 decigrms.

ACTION AND THERAPEUTICS OF POTASSIUM CARBONATE.

These are the same as those of potash, but th
carbonate is less caustic.

1. Potassii Bicarbonas. Potassium Bicarbonate. $KHCO_3$.

SOURCE.—Pass carbonic anhydride through a strong aqueous solution of potassium carbonate, and let the bicarbonate crystallize out.

CHARACTERS. Non-deliquescent, colourless monoclinic prisms. Taste mildly alkaline. *Solubility.*—1 in 4 of water

Twenty grains neutralize 14 *grains of citric acid or* 15 *grains of tartaric acid.*

IMPURITY.—The carbonate.

Dose, 5 to 30 gr. 3 to 20 decigrms.

ACTION OF POTASSIUM BICARBONATE.

The potassium bicarbonate is too feebly caustic to be of any use as a caustic. Otherwise its actions are those of potash.

THERAPEUTICS OF POTASSIUM BICARBONATE.

Stomach. Potassium bicarbonate inhibiting the gastric secretion is very useful when an excessive quantity of gastric juice is secreted. Often such juice is ineffectual, and much dyspepsia results, but normal gastric juice is secreted when the alkali has rested the glands. The increase of the antiseptic acid secretion is desirable in cases of dyspepsia associated with fermentation in the stomach. The drug may be taken after meals if too much acid is secreted, and the patient suffers from acid eructations, especially if pain is present also, but it is better treatment to remove the cause of the dyspepsia. It is not a common remedy for dyspepsia, bicarbonate of sodium being usually preferred. Either is beneficial when much mucus is present, for this is rendered less viscid by alkalies. It should not be used as an alkali in cases of poisoning by mineral acids, because of the evolution of carbonic acid gas. Bicarbonates are used in preference to carbonates, as the latter are far too strongly alkaline for the stomach. Potash water is often drunk as an effervescing water instead of soda

water. It should be a solution (30 gr. to the pint) o
potassium bicarbonate in water into which CO_2 ga
under a pressure of four atmospheres has been passe

Pancreas.—Alkalies decrease the pancreatic secre
tion, for they inhibit the formation of gastric juic
and the pancreatic flow is excited by acids.

Blood.—Potassium bicarbonate circulates i
the blood as such. It was formerly much used i
rheumatic fever, but is now superseded by salicylat
Probably it did no good. In gout it is given to in
crease the alkalinity of the blood which contains a
excess of uric acid, but there is no evidence that i
benefits gout, and the many alkaline mineral water
used for this disease are efficacious because the
cause diuresis and render the urine less acid, thu
assisting the excretion of uric acid. Potassium bicar
bonate is believed to be hæmatinic: that is to sa
it is thought to increase the amount of hæmoglobin
but as for this purpose it is usually given with iro
its hæmatinic power has not yet been proved.

Kidneys.—It is not much used for its diureti
effect and its alkalizing power over the urine, as th
vegetable salts are preferable.

5. Potassii Acetas. Potassium Acetate, KC H O

SOURCE.—Obtained by fusing the product of the inter
action of acetic acid and potassium carbonate. It contain
not less than 90 per cent. of pure potassium acetate.

CHARACTERS. White, foliated, very deliquescent, satin
neutral masses or granular particles of peculiar odou
Solubility. 2 in 1 of water.

IMPURITIES. The carbonate and metallic impurities

Dose, 15 to 60 gr.—1 to 4 grms.

6. Potassii Citras. — Potassium Citrat
K C H O .H O

SOURCE. Neutralize potassium carbonate with a solu
tion of citric acid, and evaporate to dryness.

CHARACTERS. A white, deliquescent powder. Taste [illegible]
feebly acid. *Solubility.* 10 in 6 of water.

Dose, 15 to 60 gr.—1 to 4 grms.

ACTION OF POTASSIUM ACETATE AND CITRATE.

External. No action. Being neutral they are not even antacid.

Internal. These are the least irritating to the stomach of all potassium salts; being neutral they have no action on gastric juice. They circulate as the carbonate of potassium. Both are more powerfully diuretic than any other potassium salts, and act by directly stimulating the renal cells. They are **diaphoretic**, especially the citrate, but neither of them causes a great increase of the perspiration. How they produce this effect is not certainly known.

THERAPEUTICS OF POTASSIUM ACETATE AND CITRATE.

As neither impairs digestion, they are chiefly used for remote effects.

Blood. They have been largely given for rheumatic fever, but are now rarely employed. Many believe both salts are of great value in gout; if that is so, as they do not increase the power of blood plasma to dissolve sodium biurate, they probably act by aiding the excretion of uric acid. They are powerfully antiscorbutic, that is to say, they prevent scurvy; but they are not so efficacious as lemon juice, lime juice, and fresh vegetables.

Kidneys. Although in health the diuresis produced by citrate and acetate of potassium is slight, and the urea and other solids of the urine are actually decreased, yet clinical experience shows that both are, in Bright's disease, diuretics. They are frequently used in this disease and in feverish conditions, and also to increase the amount of urine, and thus to remove pathological fluids in cases of pleuritic effusion, ascites, &c. Diuretics are best combined, and the following is a good mixture: Potassium acetate, 20 gr.

(12 decigrms.); tincture of squill, 10 ♏ (6 decimils); spirit of nitrous ether, 30 ♏ (18 decimils); Succu Scoparii, 1 fl. dr. (4 mils); water to 1 fl. oz. (30 mils)

They render the urine **alkaline**, and are much employed for this purpose, having the advantage ove other potassium salts that they do not derange digestion. They are of use in tubal nephritis, fo the urinary alkalies aid the expulsion of fatty casts. Not only do they prevent the precipitation of uric acid, and thus hinder the formation of **uric acid gravel**, but perhaps they wil dissolve small uric acid calculi. To keep the urine at the alkalinity necessary for this purpose, 15 to 60 grains (3 to 4 grms.) of the acetate or citrate should be dissolved in four ounces (120 mils) o water, and taken every four hours. If more than this is used, harm is done, for an insoluble biurate forms on the surface of the calculus. With many patients it suffices if such a dose in a tumbler of water be taken at bed-time; for during the night the acidity of the urine is highest, as there is no alkaline tide due to meals. Owing to the depressing action of potassium salts, they should be used with care in persons suffering from heart disease

Skin.—Both these salts may be used in sligh pyrexia, such as that of a common cold, on accoun of their diaphoretic properties.

Lungs.—These salts, like the carbonates and bicarbonates, are mild saline expectorants, especially suitable for cases of bronchitis, with viscid, scanty expectoration, as they increase the secretion and lessen the viscidity. The iodide of potassium is however, still more efficacious.

7. Potassii Sulphas. Potassium Sulphate K_2SO_4.

SOURCE. Obtained by the interaction of sulphuric aci and potassium chloride or certain other potassium salts.

Characters. Hard, colourless, rhombic prisms, terminated by six-sided pyramids. Taste, disagreeable. *Solubility.* 1 in 10 of water.

Impurities.—Other sulphates and chlorides.

Dose, 15 to 45 gr.—1 to 3 grms.

It is contained in Pilula Colocynthidis Composita, 1 in 20, Pilula Colocynthidis et Hyoscyami, 1 in 32, Pilula Ipecacuanhæ cum Scilla, 1 in 2, Pulvis Ipecacuanhæ Compositus, 8 in 10 (in the last two merely as a diluent).

8. Potassii Tartras. Potassium Tartrate $K_2C_4H_4O_6)_2.H_2O$.

Source. Neutralize acid potassium tartrate with potassium carbonate.

Characters. Small, colourless, deliquescent prisms. *Solubility.* 10 in 8 of water.

Impurities.—Acid tartrate and carbonate of potassium.

Dose, 30 to 60 gr. 2 to 4 grms. (diuretic); **30 to 24 grs.—2 to 16 grms.** (purgative).

9. Potassii Tartras Acidus. Acid Potassium Tartrate. $KHC_4H_4O_6$. *Synonyms.* Bitartrate of potash; Cream of tartar.

Source.—Obtained by purification from crude tartar (argol) deposited on the sides of wine casks during the fermentation of grape juice.

Characters. A fine, white, gritty powder or pieces of a [illegible] crystalline mass. Taste, pleasant, acid. *Solubility.* 1 in 200 of cold water.

Impurity.—Calcium tartrate.

Dose, 15 to 60 gr.—1 to 4 grms.

It is contained in Confectio Sulphuris, Pulvis Jalapæ Compositus, and Trochiscus Sulphuris.

Action of Potassium Sulphate, Tartrate, and Acid Tartrate.

External. One of these being only slightly acid and the others neutral, they have none of the external caustic or antacid properties of other potassium salts.

Internal. *Intestines.* All three salts are typic hydragogue **saline purges**, producing easy, sof watery motions without griping. Their mode action has already been fully described (*see* p. 97).

Liver. The **sulphate** of potassium is by som believed to be a moderate **cholagogue**, slightly increasing the biliary flow.

Kidneys.— The **tartrate** and **acid tartrate** a **diuretics**, because **a** small amount of them is, in th intestine, converted into a carbonate and absorbe and this acts directly on the renal cells. Hence the render the **urine alkaline**. But all the sulphate an most of the tartrate and acid tartrate is excrete with the fæces, and if, as seems probable, some absorbed by the small intestine in the form in whic it is taken, it is excreted again into the colon.

Therapeutics of Potassium Sulphate, Tartrate, and Acid Tartrate.

Internal. *Intestines.*—These excellent purgatives are frequently used, especially for habitua sluggishness of the bowels. A dose should be dissolved in a tumbler of warm water, and sipped durin dressing. They may be employed to open th bowels in cases, such as dropsy or uræmia, in whic we wish to eliminate as much fluid as possibl They should for this purpose be given in a concentrated form, for then a large amount of fluid wil be poured from the intestine to bring the solutio of the salt to that degree of dilution at which it wil act. Compound jalap powder is also much used fo this class of case. As sulphate of potassium ma have some cholagogue action it is to be preferre when it is believed that the liver is at fault.

Liver.—These salts are often given to those wh suffer from gall-stones, although no salts of potassiu have any power to dissolve gall-stones, but the sulphate perhaps does good as a cholagogue.

Kidneys. The tartrate and acid tartrate are sometimes used as diuretics in the same class of case as the acetate and citrate. A very pleasant drink for feverish patients is Imperial drink. It contains acid potassium tartrate, 60 gr. (4 grms.); glusidum, 1 gr. (6 centigrms.); oil of lemon, 3 ♏ (18 centimils) to a pint of boiling water.

10. Potassii Nitras. Potassium Nitrate. KNO_3.
Synonyms. Nitre; Saltpetre

SOURCE. Obtained by the action of sodium nitrate and potassium chloride

CHARACTERS.—White, striated, six-sided prisms. Taste cool, saline. *Solubility.*—1 in 4 of water.

IMPURITIES.—Sulphates, chlorides, and lime.

Dose, 5 to 20 gr. 3 to 12 decigrms.

ACTION OF POTASSIUM NITRATE.

External.—Nothing noteworthy.

Internal. *Stomach and Intestines.*—Nitrates are powerful irritants and depressants, and therefore potassium nitrate is liable to cause nausea, vomiting, diarrhoea, symptomatic of the gastritis and enteritis produced by it.

Blood.—Owing to its high diffusion power it quickly passes into the blood unchanged. External to the body, nitrates prevent the coagulation of the blood, or dissolve the clot if it be already formed. But it is not known that they have any effect on the blood in the body.

Heart. Unlike other potassium salts the nitrate is a cardiac **depressant**, causing the beats to become feeble and few. Large doses lead to great weakness, fainting, and death.

Kidneys. Small doses are **diuretic** from their direct action on the renal cells, but large ones are apt to inflame the urinary passages, causing hæmaturia. The drug is excreted unchanged in th urine.

Skin. Nitrate of potassium is a mild **diaphoreti**

THERAPEUTICS OF POTASSIUM NITRATE.

Internal.—*Blood.* On account of its suppose action in preventing the coagulation of the livin blood, it has been used in rheumatic fever and man inflammatory conditions, but it is now discarded. Probably, as it is a cardiac depressant, it only does harm

Kidneys and Skin.—It is sometimes employed a a diuretic and diaphoretic in febrile conditions, bu the acetate and the citrate are much preferable.

Asthma.—For the treatment of this disease, blotting paper is soaked in a solution of nitre of abou 50 gr. (3 grms.) to the fluid ounce (30 mils) of water six pieces about 1½ inch square are, when dry successively placed in a jar and lighted one at a time The patient inhales the fumes, the composition o which is not certainly known. Ringer considers i better to dip the paper also into a solution of chlorat of potash, and to burn a piece large enough to fil a whole room with the fumes. This treatment ofte relieves, and nitre is a common ingredient of asthma powders.

11. Potassii Chloras. Potassium Chlorat $KClO_3$.

SOURCE.—Pass chlorine into water holding lime or magnesia in suspension; treat the liquid with potassium chlorid and crystallize the potassium chlorate.

CHARACTERS.—Colourless, monoclinic crystals. Taste cool. *Solubility.* 1 in 16 of cold water.

INCOMPATIBLES.—Easily explodes on trituration with many substances, especially sugar, sulphur, tannin, charcoal and glycerin.

IMPURITIES.—Calcium chloride and lime.

Dose, 5 to 15 gr.—3 to 10 decigrms.

Preparation.

Trochiscus Potassii Chloratis. 0·2 grm. o 3 gr. in each with a rose basis.

ACTION OF POTASSIUM CHLORATE.

External. It is believed to be easily decomposed on septic tissues, and that the nascent oxygen given off acts as a stimulant and antiseptic to them.

Internal. *Stomach and Intestines.* Small doses have no effect; poisonous ones produce symptoms similar to those induced by the nitrate.

Blood. Here also small doses have no effect, but several cases of poisoning show that in large doses chlorate of potassium disintegrates the red corpuscles, and converts hæmoglobin into **methæmoglobin.** The altered blood, owing to loss of oxygen-carrying power, causes the skin to be cyanotic; it is passed by the urine, which is therefore dark-coloured, and contains granular *débris*, and thus the **urine** is exactly like that met with in **paroxysmal hæmoglobinuria.** The liver and spleen are enlarged. There may be jaundice and hæmatemesis, and the marrow of the bones becomes very vascular. Nephritis is induced, the tubules are blocked by the *débris* of the blood, and so the urine is scanty. Death occurs from cardiac weakness or uræmia.

As potassium chlorate easily yields up its oxygen, formerly it was believed that it gave off part of its oxygen to the tissues while circulating in the blood. Much of it is excreted unchanged in the urine and other excretions.

THERAPEUTICS OF POTASSIUM CHLORATE.

It is used for stomatitis, tonsilitis, and pharyngitis of all varieties, either as lozenges, gargle (10 gr. (6 decigrms.) to 1 fl. oz. (30 mils) of water or decoction of cinchona), or given to be swallowed in solution, for it is then excreted by the saliva. Its therapeutic action, which has been thought to be due to nascent oxygen, is therefore always local. It is

especially valuable for **ulcerative stomatitis.** It h
been given to women liable to miscarry.

12. Potassii Bichromas, *see* Chromium.

13. Potassii Permanganas, *see* Manganese.

14. Potassii Iodidum, *see* Iodine.

15. Potassii Bromidum, *see* Bromine.

16. Potassa Sulphurata, *see* Sulphur.

17. Sapo Mollis. Soft soap. Is Potassium Ole
Olive Oil.

SODIUM.

Symbol, Na. Atomic weight, 23. (Not official.)

The metal sodium as met with in commerce. It dec
poses water, and must therefore be kept under naphtha.

CHARACTERS.—Well known.

The sodium ion has no physiological action, and the
re all sodium salts act either by salt action or by t
action of the other ion.

1. Sodii Carbonas. Sodium Carbonate. Na_2C
$10H_2O$. *Synonym.* - Soda or washing soda.

SOURCE.- Obtained from sodium chloride by interacti
with ammonium bicarbonate, ignition and subseque
crystallization.

CHARACTERS. — Large oblique rhombic crystals, tra
parent when fresh, but they soon effloresce, and become wh
on the surface. Taste, caustic. *Solubility.*—1 in 2 of cold wat

Twenty grains neutralize 9·8 grains of citric acid
10·5 *grains of tartaric acid.*

IMPURITIES. Sulphates and chlorides.

Dose, 5 to 30 gr. 3 to 20 decigrms.

2. Sodii Carbonas Exsiccatus. Exsiccat
Sodium Carbonate. Na_2CO_3. It is nearly anhydrous.

SOURCE. Sodium carbonate is gently heated till losi
water of crystallization it loses 63 per cent. of its weight.

CHARACTERS. —A dry white powder.

It is contained in Pilula Ferri (carbonate of iron is forme

Dose, 3 to 10 gr. 2 to 6 decigrms.

ACTION AND THERAPEUTICS OF SODIUM CARBONATE AND DRIED CARBONATE.

The same as those of potash, except that they are less caustic.

3. Sodii Bicarbonas.—Sodium Bicarbonate. $NaHCO_3$.

SOURCE. Made from the carbonate in the same way as potassium bicarbonate is made. Or, by the interaction of sodium chloride and ammonium bicarbonate.

CHARACTERS. A white powder or small monoclinic crystals. Slightly alkaline; not caustic. *Solubility.* 1 in 11 of cold water.

Twenty grains neutralize 16·7 *grains of citric acid or* 17·8 *grains of tartaric acid.*

IMPURITIES. The carbonate.

INCOMPATIBLES. It is decomposed by acids and acid salts, *e.g.* bismuth subnitrate.

Dose, 5 to 30 gr. 3 to 20 decigrms.

ACTION OF SODIUM BICARBONATE.

Sodium salts are not, when locally applied, depressant to the cardiac, muscular, and nervous systems, and therefore are not locally poisonous like potassium salts. Sodium bicarbonate is more slowly absorbed than the potassium salt, but after absorption its action is the same.

THERAPEUTICS OF SODIUM BICARBONATE.

External. A lotion of 7 gr. 5 decigrms. to 1 oz. 30 mils of water is employed as a sedative to relieve itching.

Internal. *Stomach.* Its use in disease is very similar to that of the corresponding salt of potassium, but on account of the two differences just mentioned it is much more frequently given. Hence it is a very

common ingredient of medicines designed to rel
dyspepsia, being taken shortly after meals to inh
the flow of ineffectual gastric juice, or some t
afterwards to neutralize excessive acidity in the ca
in which the patient complains of pain, which
relieved by food and comes on about four hours a
a meal, or of heartburn and acid eructations.
value is also partly due to its sedative action on
gastric nerves, whereby it relieves gastric pain, a
partly also to its power of liquefying tenacious muc
A very favourite gastric sedative mixture consists
about 10 grains (6 decigrms.) of sodium bicarbona
together with 10 grains (6 decigrms.) of bismu
carbonate, suspended in mucilage. A grain or two
sodium bicarbonate, with a grain of powdered rhuba
and some sugar, forms a common stomachic powd
for children. Sodium bicarbonate and gentian a
also often combined together in stomachic mixtur
Effervescing soda water (made the same way
potash water, p. 133) is a mild gastric sedative.
commerce these waters often contain neither pota
nor soda, but even then the carbonic acid gas acts
a sedative.

Sodium bicarbonate is so slowly absorbed, and
in comparison with potassium salts, so poor a solve
of uric acid, that it is rarely used for any effects
may have after absorption. Large doses (150 to 5
grains, 10 to 33 grms. a day) are useful for diabe
coma and all forms of acidosis, in which th
neutralize the excess of acids in the blood.

TOXICOLOGY.

Poisoning by caustic alkalies is very rare; usually it tak
place either by potash, soda, pearlash (potassium carbonat
or soap lees (sodium carbonate). (Both the last are impu
They contain caustic soda or potash.)

Symptoms.— A caustic taste is experienced, and is quick
followed by symptoms of gastro-intestinal irritation, viz. bur

ing heat in the throat, vomiting, diarrhœa, and abdominal pain, together with those of depression, viz. a feeble quick pulse, and a cold and clammy skin. Soon the lips, tongue, and throat become swollen, soft, and red. *Post-mortem appearances.*—The mucous membrane of the mouth, tongue, stomach, and œsophagus, and occasionally that of the larynx, is excoriated, dark, softened, and inflamed.

Treatment. Wash out the stomach, or give emetics, as zinc sulphate, 20 gr. (12 decigrms.); or powdered ipecacuanha, 30 gr. (2 grms.); or copper sulphate, 5 gr. (3 decigrms.) in half a pint of tepid water; or vinum ipecacuanhæ, 1 fl. oz. (30 mils); or mustard, a tablespoonful in half a pint of tepid water; or common salt, 2 tablespoonfuls in half a pint of tepid water; or $\frac{1}{10}$ gr. (6 milligrms.) of apomorphine hydrochloride hypodermically. If none of these is handy, give plenty of warm water and tickle the back of the throat. Then give feeble acids, as vinegar, diluted lemon juice, dilute solution of citric acid, dilute acetic acid. Then demulcents, as oil, linseed tea, or water and white of egg.

4. Sodii Phosphas.

Sodium Phosphate. $Na_2HPO_4,12H_2O$.

Source.—Obtained by the interaction of sodium carbonate and the solution of acid calcium phosphate produced by mixing bone ash and sulphuric acid.

Characters.—Transparent, colourless, efflorescent rhombic prisms. Taste, mildly saline. *Solubility.* 1 in 7 of cold water.

Impurity.—Calcium phosphate.

Dose, 30 to 120 gr.—2 to 8 grms.—for repeated administration, **$\frac{1}{4}$ to $\frac{1}{2}$ oz.—10 to 16 grms.**—for single administration.

5. Sodii Phosphas Effervescens.

Effervescing Sodium Phosphate.

Source.—Dry 50 of sodium phosphate till it has lost 60 per cent. of its weight as water. Mix with it sodium bicarbonate, 50; tartaric acid, 27; citric acid, 18. Heat the mixture till it aggregates, and then stir till it assumes a granular form.

Characters.—White granules, which effervesce on the addition of water.

Dose, 60 to 120 gr.—4 to 8 grms.—for repeated administration, **$\frac{1}{4}$ to $\frac{1}{2}$ oz.—10 to 16 grms.**—for single administration, in 3 to 6 fl. oz. of water.

6. Sodii Sulphas. Sodium Sulphate. Na_2SO $10H_2O$. *Synonym.* Glauber's salts.

Source.—Obtained by the interaction of sodium chloride with sulphuric acid.

Characters. Colourless, monoclinic transparent prisms efflorescing on exposure to air. Neutral; taste, saline *Solubility.* 1 in 3 of water.

Impurities. Salts of ammonium and iron.

Dose, 30 to 120 gr. 2 to 8 grms. for repeated administration. **¼ to ½ oz. 10 to 16 grms.** for single administration.

7. Sodii Sulphas Effervescens. Effervescing Sodium Sulphate.

Source. Dry 50 of sodium sulphate till it has lost 55 per cent. of its weight as water. Then mix with it sodium bicarbonate, 50; tartaric acid, 27; citric acid, 18. Heat the mixture till it aggregates, and then stir till it assumes a granular form.

Characters. White granules, which effervesce on the additjon of water.

Dose, 60 to 120 gr. 4 to 8 grms. for repeated administration. **¼ to ½ oz. 10 to 16 grms.** for single administration in 3 to 6 fl. oz. of water.

8. Sodii et Potassii Tartras. Sodium Potassium Tartrate. $NaKC_4H_4O_6,4H_2O$. *Synonyms.* Tartrate of sodium and potassium, tartarated soda, Rochelle salt.

Source. Neutralize acid potassium tartrate with sodium carbonate.

Characters. Large, colourless, neutral, trimetric prisms. Taste like common salt. *Solubility.*—1 in 1·5 of cold water.

Impurity.—Acid potassium tartrate.

Dose, 120 to 240 gr.—8 to 16 grms.

Preparation.

Pulvis Sodæ Tartaratæ Effervescens.—*Synonym.*—Seidlitz powder. Take tartarated soda 7·5 grms. and sodium bicarbonate 2·5 grms.; mix and wrap in blue paper. Tartaric acid 2·5 grms., wrapped in white paper.

Dose.—Dissolve the powder in the blue paper in nearly half a pint of cold or warm water, and then add that in the white paper, and drink while effervescing.

9. Sodii Citro-Tartras Effervescens.

Effervescent Sodium Citro-tartrate.

SOURCE.—Mix sugar, 15, sodium bicarbonate, 51, citric acid, 18, and tartaric acid, 27. Heat the mixture till it aggregates and assumes a granular form.

CHARACTERS. White deliquescent granules, which effervesce on the addition of water.

Dose, 60 to 120 gr. 4 to 8 grms. in 3 to 6 fl. oz. of water.

ACTION OF SODIUM PHOSPHATE, SULPHATE, CITRO-TARTRATE, AND TARTARATED SODA.

Internal.—*Intestines.* Owing to the slowness with which, compared with the corresponding potassium salts, these sodium salts are absorbed, they pass on into the intestine and there act more efficiently than potassium salts. They are typical **saline purgatives**, producing a soft motion about two or three hours after administration (*see* p. 97).

The sulphate, which is the most active purgative, and the phosphate are said to be cholagogues, and Carlsbad waters (*see* p. 148) have been shown to increase in the human subject the amount of bile and the solids in it.

Blood and Kidneys.—Owing to their tardy absorption the action of these salines, as alkalizers of the blood and urine, and as diuretics, is more feeble than that of the corresponding potassium salts.

THERAPEUTICS OF SODIUM PHOSPHATE, SULPHATE, CITRO-TARTRATE, AND TARTARATED SODA.

Internal.—*Intestines.* These salts of sodium are one of the best purgatives we possess, being especially useful for habitual constipation, and for constipation associated with gout, with hepatic dyspepsia, with any of the manifestations of an excess of uric acid in the blood or the urine. The best way to take them is to dissolve the required amount in half a tumbler of lukewarm water, and to drink it in successive small draughts while dressing in th morning. The bowels are then usually comfortabl opened soon after breakfast. These salts, especiall the phosphate and sulphate, are perhaps cholagogues these two are therefore to be preferred in cases o gall-stones and disease of the liver. The sulphate i the most powerful purgative of all. It is the chie constituent of Carlsbad, Marienbad, Tarasp, and Conda waters, and it occurs associated with much sulphate of magnesium in Æsculap, Hunyadi János, Seidlitz Pullna, Friedrichshall, Rubinat, Apenta, and Kissingen waters. A powder consisting of 30 grains (2 grms. of each of sodium sulphate and magnesium sulphate and a grain of each of sodium chloride and sodium bicarbonate (dose 60 to 240 grs., 4 to 16 grms. forms when dissolved a good imitation of Æsculap Hunyadi János, and Franz Josef waters. The phosphate is a milder and less unpleasant purgative than the others; it is often given to children. The effervescing preparations are palatable forms.

If large doses are used the evacuations are very watery, and therefore these drugs are useful to remove fluid in cases of dropsy or ascites (especially it due to disease of the liver). Sufferers from gallstones are undoubtedly benefited by a course of waters containing sulphate of sodium, and therefore frequently go to Carlsbad. Hourly doses of sodium ulphate are excellent for bacillary dysentery.

10. Sodii Chloridum. Sodium Chloride. NaCl.
Synonym. Common salt.

SOURCE.—Obtained by purifying common salt.

CHARACTERS.—Small, white, crystalline grains or transparent cubic crystals. *Solubility.*—1 in 3 of cold water.

ACTION OF SODIUM CHLORIDE.

Common salt forms an article of diet with all creatures living on vegetable food, especially if it contains large amounts of potassium, but is not used taken by carnivorous animals or by tribes living solely on flesh. The importance of it is seen in the long distances herbivorous animals will wander to salt-licks, and by the fact that tribes living on vegetables will go to war for the possession of it. Bunge's explanation of this desire for salt is as follows: Blood plasma contains much sodium chloride, vegetable foods contain a large amount of potassium salts; when, therefore, these salts of potassium reach the blood, potassium chloride and the sodium salt of the acid which was combined with the potassium are formed. This and the potassium chloride are excreted by the kidneys, and the blood loses its sodium chloride, which loss is therefore made up by taking sodium chloride with the food. The deprival of salt leads to general weakness, œdema, and anæmia, a series of symptoms often seen in France before the repeal of the salt tax.

Quantities of a tablespoonful and upwards act as an emetic, and may also purge, for the hypertonic solution withdraws fluid from the gastro-intestinal mucous membrane, and so acts as an irritant. Rectal injections of solutions of salt are used as an anthelmintic for the *Oxyuris vermicularis*.

THERAPEUTICS OF SODIUM CHLORIDE.

It is occasionally used as an emetic, also as an anthelmintic. Bathing in sea water acts as a mild general stimulant, and very concentrated hot salt baths, such as those of Droitwich and Nantwich, are used for chronic rheumatism and sciatica. Ninety grains of common salt (0·9 per cent. is isotonic with blood) in a pint of boiled water allowed to cool to 100° F. (38·5° C.) form a normal saline solution, which is frequently injected in cases of collapse in which the fluid in the blood-vessels is lessened, as from hæmorrhage, vomiting, or diarrhœa, often with strikingly good results. A pint or rather more is usual quantity to employ for an adult. It may injected into the rectum, under the skin, or into vein, according to the urgency. Such injections ha also been used for diabetic coma, and may rend the patient sensible again for a little while as th dilute the excess of poison in the blood.

11. Sodii Sulphis. Sodium Sulphite. Na_2S $7H_2O$.

SOURCE.—Saturate a solution of sodium carbonate wi sulphurous acid gas.

CHARACTERS.—Colourless, transparent, monoclinic prism Contains not less than 94 per cent. of pure sodium sulphi *Solubility.*—1 in 2 of water.

Dose, 5 to 20 gr. 3 to 12 decigrms.

ACTION AND THERAPEUTICS OF SODIUM SULPHIT

Sodium sulphite solutions (1 in 8) may be use externally as mild antiparasitics. This body in the stomach decomposed by the acids there, an gives off sulphurous anhydride. It may therefor be given to arrest fermentation. If any remains un decomposed it is absorbed as a sulphite. No othe action of this salt is known. It is very rarely give in medicine, but in sufficient doses might produc the effects of sodium sulphate.

12. Acid Sodium Phosphate. *Synonyms.* Sodium di-hydrogen phosphate; Sodium biphosphate. contains not less than 70 per cent. of pure sodium di-hydroge phosphate, NaH_2PO_4.

CHARACTERS.—Transparent, colourless, rhombic crystal or in crystalline powder. Taste saline acid. Readily solub in water, the solution being acid to litmus.

Dose, 30 to 60 gr.—2 to 4 grms.

ACTION AND THERAPEUTICS.

This salt is the cause of the natural acidity o the urine, and given internally in doses of 30 gr

2 grms.) in water every hour. It increases the acidity of the urine and is very useful when that fluid is alkaline from decomposition in the urinary tract. It may be given with urotropine.

13. Sodii Citras. Sodium Citrate. (Not official.) Much of the indigestion that follows giving cow's milk to infants is owing to the fact that the curds of cow's milk formed in the stomach are very dense. The density is proportionate to the amount of calcium in the milk. If citrate of sodium is added, calcium citrate is formed and the curds are much less dense. It is found that if to each ounce of cow's milk a [illegible] of water containing a grain of sodium citrate is added, the curds are not dense, the indigestion is relieved, and the absorption of sufficient calcium from the milk is not prevented. Judged by clinical experience sodium citrate thus given to infants seems beneficial, but it has been stated that although outside the body it lessens the curdling of milk, it does not do so in the presence of the gastric juice. The same treatment may be applied to the milk given to those suffering from typhoid fever, for here also dense curds are troublesome.

14. Sodii Bromidum, *see* Bromine.
15. Sodii Iodidum, *see* Iodine.
16. Sodii Hypophosphis, *see* Phosphorus.
17. Sodii Arsenas Anhydrosus, *see* Arsenic.
18. Liquor Sodæ Chlorinatæ, *see* Chlorine.
19. Sodii Nitris, *see* Nitrites.
20. Sodii Benzoas, *see* Acidum Benzoicum.
21. Sodii Salicylas, *see* Acidum Salicylicum.
22. Borax, Sodium Biborate, *see* Acidum Boricum.
23. Sapo Durus, Hard Soap, is Sodium Oleate.
24. Sapo Animalis, Curd Soap, is chiefly Sodium Stearate.

AMMONIUM.

Symbol, NH_4. (Not official.)

1. Liquor Ammoniæ Fortis. Strong Solution of Ammonia. NH_3 (32·5 per cent. dissolved in water).

Source. Generate ammonia gas by heating ammonium chloride with slaked lime, and pass it into water.

Characters. A colourless liquid, of a very pung
odour, and very alkaline. Sp. gr. 0·888.

Impurities. Ammonium chloride, sulphide, and sulpha
pyridine and other compound ammon[illegible].

Preparations.

1. Linimentum Camphoræ Ammoniatum
Synonym.—Compound liniment of camphor. Liq
Ammoniæ Fortis, 250; camphor, 125; oil of laven
5; alcohol (90 per cent.) to make 1000 parts.

2. Linimentum Hydrargyri, *see* Mercury.

3. Spiritus Ammoniæ Aromaticus, *see* Am
nium Carbonate.

4. Spiritus Ammoniæ Fetidus, *see* Asafeti

5. Tinctura Guaiaci Ammoniata, *see* Gu
cum.

2. Liquor Ammoniæ. Solution of Ammon
NH_3 (10 per cent. dissolved in water).

Source.—Mix strong solution of ammonia, 1 part, a
distilled water, 2 parts.

Characters. Like but less pungent than the str
solution. Sp. gr. 0·959.

Preparations.

1. Linimentum Ammoniæ. Liquor Ammoni
1; almond oil, 1; olive oil, 2. Ammonia soap
oleate of ammonium is formed.

2. Tinctura Ergotæ Ammoniata, *see* Ergo

3. Tinctura Opii Ammoniata, *see* Opium.

4. Tinctura Quininæ Ammoniata, *see* Quinin

5. Tinctura Valerianæ Ammoniata,
Valerian.

6. Tinctura Valerianæ Indicæ Ammoniat
see Indian Valerian.

ACTION OF SOLUTIONS OF AMMONIA.

External. A solution of ammonia produces **rub
faction** with a sensation of heat, and, if strong,
sensation of pain and burning. If the vapour
confined it causes vesication.

Internal. *Nose.*—When inhaled, the vapour of ammonia is irritating to the nose and air passages, causing a pungent sensation and sneezing. The eyes and nose water. The **pulse** and **respiration** are reflexly **accelerated.** If very concentrated it produces swelling and inflammation of the nose, glottis, and respiratory tract.

Stomach. As an alkali ammonia acts like other alkalies (*see* potassium bicarbonate). It dilates the gastric vessels, and produces a feeling of warmth in the epigastrium. It reflexly stimulates the **heart** and **respiration.**

Blood. Its action on the blood is not known, and it is supposed to diminish its local liability to clot in cases of thrombosis, and to dissolve clot that is already formed.

Heart. Ammonia causes a rise of blood-pressure from contraction of the arterioles following stimulation of the vaso-motor centre. Usually there is an increased pulse rate, due probably to stimulation of the accelerator mechanism.

Respiration.—It increases greatly the frequency of **respiration**, probably from stimulation of the respiratory centre in the medulla.

Nervous system. The brain is unaffected, and the nerves also, except for the tingling produced when a strong solution of ammonia is locally applied. Convulsions are often produced in animals poisoned by ammonia; these are certainly central, and are probably due to stimulation of the spinal cord.

Kidneys. Ammonia and ammonium carbonate are converted by the liver to urea, which is excreted by the kidneys. Ammonium salts of mineral acids such as the chloride are excreted unchanged. Organic salts such as the citrate and acetate are partly converted to **urea,** the acid radicle being oxidized to carbonic acid, partly excreted unchanged.

THERAPEUTICS OF SOLUTIONS OF AMMONIA.

External. The two liniments are used as counte
irritants in numerous conditions, such as chron
joint disease and chronic rheumatism, and they a
often rubbed on the chest in bronchitis. Ammon
is a very uncertain vesicant. Weak solutions of
are often applied to the bites produced by insect
Liquor ammoniæ is very valuable when held to th
nose of any one who has fainted, for it almost in
stantly reflexly produces its stimulating effect o
the heart and respiration.

Internal. Ammonia in some form may be give
before meals as a gastric stimulant in dyspepsi
Sal volatile is often used for this purpose, and al
for its general stimulating effect on the cardia
respiratory, and spinal systems, especially in sudde
collapse from any cause. Ammonia has been injecte
subcutaneously in cases of snake-bite.

3. Ammonii Carbonas.—Ammonium Carbonat
A variable mixture of ammonium hydrogen carbona
NH_4HCO_3, with ammonium carbamate $NH_4NH_2CO_2$.

SOURCE. Heat ammonium sulphate or chloride wi
calcium carbonate.

CHARACTERS.—Translucent crystalline masses, volati
and pungent to the smell. *Solubility.*—1 in 4 of water.

Twenty grains neutralize 26¾ *grains of citric acid or* 2
grains of tartaric acid.

IMPURITIES.—Sulphates and chlorides.

Dose, 3 to 10 gr. 2 to 6 decigrms.

Preparation.

Spiritus Ammoniæ Aromaticus. *Synonym.*
Spirit of sal volatile. Ammonium carbonate, 10
Liquor Ammoniæ Fortis, 200; oil of nutmeg, 1
oil of lemon, 20; alcohol (90 per cent.), 3000; wat
1500. Mix the oils with the alcohol and water. Dist
To the last portion of the distillate add the ammon
and the carbonate. Heat till solution takes place, a

then add to the first portion of the distillate. Sp. gr. 0·888 to 0·893.

It contains in alcoholic solution normal ammonium carbonate, $(NH_4)_2CO_3$, with a large excess of ammonium hydroxide.

Dose, 20 to 40 m. 12 to 25 decimils for repeated, **60 to 90 m. 4 to 6 mils** for single administration.

ACTION AND THERAPEUTICS OF AMMONIUM CARBONATE.

The external and internal actions of the carbonate are the same as those of Liquor Ammoniæ. It is not used externally, but Spiritus Ammoniæ Aromaticus is inhaled for its reflex effects, is given as a **gastric stimulant** and carminative in dyspepsia, and as a **cardiac and general stimulant** in syncope, &c. The carbonate is, in addition, an excellent **expectorant**, stimulating the respiratory secretions, and by its general stimulating effect assists the expulsion of thick mucus. It is most useful for bronchitis in children and the aged. It is an emetic acting directly on the stomach.

TOXICOLOGY.

Liquor ammoniæ and the carbonate produce symptoms like other alkalies, but are more corrosive. The air-passages are inflamed, and the inhalation of the vapour has been known to kill from this cause.

Treatment as for other alkalies (*see* p. 145).

1. Ammonii Chloridum.—Ammonium Chloride. NH_4Cl. *Synonym.*—Sal ammoniac.

SOURCE.—May be formed by neutralizing a crude solution of ammonia or ammonium carbonate with hydrochloric acid.

CHARACTERS.—Colourless crystals, volatile. *Solubility*, [illegible] water.

IMPURITIES.—Chiefly tarry matters.

Dose, 5 to 20 gr. 3 to 12 decigrms.

ACTION OF AMMONIUM CHLORIDE.

Locally applied ammonium chloride increa the secretion of mucous membranes, and to a slig extent it does the same after absorption. It is sa to be a feeble cholagogue, diaphoretic, and diuret In large doses it has the same action on the hea respiration, and nervous system as ammonia.

THERAPEUTICS OF AMMONIUM CHLORIDE.

It is a very favourite remedy for local applic tion, by means of inhalation of the vapour, increase the secretion of mucus from the pharyn Eustachian tubes, larynx, trachea, and bronchi cases of chronic pharyngitis, otitis media, laryngit and bronchitis. Many forms of apparatus for inhalation are in the market. In most of them is generated by the action of hydrochloric acid ammonia. It is occasionally given by the mou either as a cholagogue, gastric stimulant, diaph retic, or diuretic, but it is too feeble to be recon mended, and it is very nasty; the taste may to son extent be concealed by liquorice. It is sometim useful in chronic bronchitis with much expectoratic and is then best given as a lozenge. Some authoriti consider it a specific for neuralgia. It is not a gener stimulant.

5. Liquor Ammonii Acetatis. Solution Ammonium Acetate. *Synonym.* Minderer's spirit.

SOURCE.— Ammonium carbonate, 50; acetic acid, 162 water to 1000.

INCOMPATIBLES.—Potash, soda, and their carbonates, aci lime water, salts of lead and silver. Should be preserved green glass bottles.

Dose, 2 to 6 fl. dr.—8 to 24 mils.

6. Liquor Ammonii Citratis. Solution of Ammonium Citrate.

SOURCE. Dissolve 125 of citric acid in 625 of water neutralize with ammonium carbonate 87·5, and add water to make 1000. Preserve in green glass bottles.

Dose, 2 to 6 fl. dr. 8 to 24 mils.

ACTION AND THERAPEUTICS OF THE AMMONIUM ACETATE AND CITRATE.

These are mild **diaphoretics** and **diuretics** and are used only for these effects. They probably act in both cases either on the secretory cells or the nerves connected with them. They do not irritate the kidneys, but increase both the water and the solids excreted. They are employed in Bright's disease as diuretics, and in febrile conditions as diaphoretics.

7. Ammonii Benzoas. *see* Acidum Benzoicum.

8. Ammonii Bromidum. *see* Bromine.

LITHIUM.

Symbol, Li. Atomic weight, 6·94. (Not official.)

1. Lithii Carbonas. Lithium Carbonate. Li_2CO_3.

SOURCE. Obtained from native lithium silicates.

CHARACTERS. A white powder, or minute crystallin grains; alkaline. *Solubility.*—1 in 80 of water.

IMPURITIES.—Lime, alumina.

Dose, 2 to 5 gr. 12 to 30 centigrms.

2. Lithii Citras. Lithium Citrate. $C_3H_4 \cdot OH(COOLi)_3 4H_2O$.

SOURCE.—Act on lithium carbonate with citric acid.

CHARACTERS. White, crystalline powder. *Solubility.* 1 in 2 of water.

Dose, 5 to 10 gr.—3 to 6 decigrms.

3. Lithii Citras Effervescens.—Effervescent Lithium Citrate.

SOURCE. Mix 210 of citric acid and 50 of lithium carbonate, and 310 of tartaric acid and 580 of sodium bicarbonate. Granulate, heat at 100° C., when granular dry at 55° C.

Dose, 60 to 120 gr.—4 to 8 grms.

ACTION OF LITHIUM SALTS.

The official lithium salts are converted into chloride in the stomach, and if given too concentrated, or in too large doses, cause vomiting an diarrhœa, due to gastro-enteritis, which is the caus of death in animals poisoned by lithium. The gastro-enteritis occurs also if lithium is given subcutaneously, the drug being then partly excreted by th gastro-intestinal mucous membrane. However give it is excreted chiefly by the urine, and to a less exten by the saliva. These lithium salts render the urin **alkaline**, and are in virtue of their salt actio **diuretic**. Lithium biurate is readily soluble, but i only formed from concentrated solutions of lithiu salts, and hence they are useless as solvents of u acid in man. They are general depressants t muscular tissue, but in this respect they are muc less powerful than potassium salts.

THERAPEUTICS OF LITHIUM SALTS.

A lotion of the carbonate of lithium (4 gr., 2 centigrms., to 1 fl. oz., 30 mils, of water) has bee applied externally on lint covered with gutta perch to relieve the pain of gouty inflammation, to promo the healing of gouty ulcers, and to aid the disappea ance of tophi, but any benefit that may follow is d to the warmth of the application, and not to a solve action of the lithium salt upon the uric acid, fo lithium salts cannot be absorbed through the ski Salts of lithium have been much given to patien suffering from acute or chronic gout, uric ac calculus, or gravel, but in the body they must be to dilute to be of any use as a solvent of uric acid, an any improvement that follows their employmen might equally well be obtained by distilled wate It has been shown that the addition of medicin doses of lithium salts to blood serum does not increase the solubility of uric acid in it. Lithium salts should always be freely diluted. The citrate has the advantage of greater solubility. Lithium salicylate (dose, 7 to 15 grains, ½ to 1 grm.) is recommended, as salicylic acid increases the excretion of uric acid.

GROUP III.

METALS OF THE ALKALINE EARTHS AND THEIR ALLIES.

Calcium, Barium, Strontium, Magnesium.

Of these Calcium, Barium, and Strontium are metals of the alkaline earths, and Magnesium was formerly included among them.

CALCIUM.

Symbol, Ca. Atomic weight, 40·07. (Not official.)

Calcium Carbonate is pharmacopœial in two forms.

1. Creta Præparata. Prepared Chalk. $CaCO_3$.

SOURCE. Native calcium carbonate freed from most of its impurities by elutriation and drying.

CHARACTERS. White friable pieces or a dull white powder. Insoluble in water.

INCOMPATIBLES.—Acids and sulphates.

Dose, 15 to 60 gr.—1 to 4 grms.

Preparations.

1. **Hydrargyrum cum Cretâ,** *see* Hydrargyrum.

2. **Mistura Cretæ.** Prepared chalk, 30; tragacanth, 5; sugar, 60; cinnamon water, 1000.

Dose, ½ to 1 fl. oz.—15 to 30 mils.

3. **Pulvis Cretæ Aromaticus.** Prepared chalk, 25; cinnamon, 10; cloves, 4; cardamom seeds, 3; nutmeg, 8; sugar, 50.

Dose, 10 to 60 gr.—6 to 40 decigrms.

4. **Pulvis Cretæ Aromaticus cum Opio,** *see* Opium.

2. Calcii Carbonas Præcipitatus. Precipitated Calcium Carbonate. $CaCO_3$. *Synonym.*—Precipitated chalk.

Source.—Boil together solutions of calcium chloride and sodium carbonate.

Characters.—A white crystalline powder insoluble in water.

Impurities.—Chlorides, alumina, and iron.

Incompatibles.—Acids and sulphates.

Dose, 10 to 60 gr.—1 to 4 grms.

Contained in Trochiscus Bismuthi Compositus.

Action of Calcium Carbonate.

External.—It is mildly astringent and helps to dry moist surfaces.

Internal.—*Stomach and Intestines.*—Calcium carbonate is **antacid.** It is a mild but certain **astringent.** How it acts as an astringent is unknown. Very nearly all of any calcium salt is excreted unchanged in the fæces.

Absorption.—When calcium salts are taken, small quantities are absorbed; most of that absorbed is excreted by the epithelium of the large intestine, the rest by the kidneys. Calcium is necessary for all forms of protoplasm, thus many lowly organisms die when placed in water from which it is absent.

Kidneys.—Because certain mineral waters containing bicarbonates and sulphate of calcium, amongst other salts, have been used successfully in cases o urinary gravel and calculi, it has been asserted tha these salts are diuretic, and solvent for uric acid, but i is more likely that the beneficial effects of these water are due merely to the large amount of water drunk anyhow, there is no proof that it is due to the salts Such waters are those of Contrexéville and Vittel.

Therapeutics of Calcium Carbonate.

External.—Prepared chalk forms an excellen dusting powder for moist eczema.

Internal.—*Alimentary canal.*—Because of it mechanical action it is a good tooth powder. The following is a good formula: Potassium chlorate, 32 gr. (21 decigrms.); powdered hard soap, 80 gr. (48 decigrms.); carbolic acid, 20 gr. (12 decigrms.); oil of cinnamon, 10 ♏ (6 decimils); precipitated calcium carbonate to 1 oz. (30 grms.). Mistura Cretæ and Pulvis Cretæ Aromaticus, particularly the former, are very valuable for checking mild diarrhœa, especially in children.

Kidneys.—There is no doubt that persons passing gravel or urinary calculi, especially if composed of uric acid, are benefited by drinking the waters of Contrexéville and Vittel. They should be taken in quantities of 3 to 6 pints a day and between meals, to avoid the large amount of fluid causing indigestion. At Contrexéville the great bulk is drunk before breakfast.

3. Calx.—Lime. Calcium oxide. CaO.

SOURCE.—Made by calcining marble.

CHARACTERS. Compact masses of a whitish colour which rapidly absorb water, and then swell and crack, with great evolution of heat, and fall into a powder (slaked lime).

4. Calcii Hydras.—Calcium Hydroxide. *Synonym.* Slaked Lime. $Ca(OH)_2$.

SOURCE.—Prepared by the interaction of water and calcium oxide.

CHARACTERS.—A white, strongly alkaline powder. *Solubility,* 1 in 900 of cold water; if sugar be added 1 in 60.

IMPURITIES. Those of the lime, viz. iron, alumen, silica.

INCOMPATIBLES. Acids, metallic salts, tartar emetic.

Preparations.

1. Liquor Calcis. *Synonyms.*—Aqua calcis. Lime water. Shake up washed calcium hydroxide 50 in distilled water 5000, and siphon off. To be kept in green glass bottles. *Strength,* 0·1 per cent., $\frac{1}{10}$ gr. in 110 ♏; 0·1 grm. in 100 millilitres.

Dose, 1 to 4 fl. oz.—30 to 120 mils.

2. Liquor Calcis Saccharatus. Shake up calcium hydroxide 50 and sugar 100 in water 1000, and siphon off. Is a solution of calcium saccharosat To be kept in green glass bottles. *Strength*, 2 pe cent., 2 gr. in 110 m ; 2 grm. in 100 millilitres.

Dose, 20 to 60 m.—1 to 4 mils.

3. Linimentum Calcis.—Equal parts of lim water and olive oil. Lime soap or calcium oleate formed.

Carron oil is composed of equal parts of lime wat and linseed oil.

Liquor calcis is used in preparing Lotio Hydrargy Flava, and Lotio Hydrargyri Nigra.

ACTION OF LIME AND SLAKED LIME.

External. Slaked lime is caustic. Lime wat is astringent.

Internal. *Alimentary tract.* Lime is antaci It prevents milk from forming solid bulky curds i the stomach. It **allays vomiting**, and is an antido for poisoning by mineral acids, oxalic acid, and zi chloride. It acts as a mild intestinal **astringent**.

THERAPEUTICS.

External.—Slaked lime, employed as a causti is usually mixed with caustic potash, when it form Vienna paste, used to destroy warts and other sma growths. Lime water applied to weeping eczem is especially serviceable if mixed with glycer Linimentum Calcis is very valuable for burns.

Internal.—Lime water is much used to mix wi milk to prevent its forming thick curds in th stomach, especially when, as is often the case wi children, the curds cause vomiting. It is difficult understand how it acts, for although lime water co tains so little lime it is often efficacious. In seve cases of infantile vomiting, equal parts of milk an lime water may be ordered. If it is undesirable dilute the milk so much, the saccharated lime wat is an excellent preparation. Lime water will che slight diarrhœa. It is a useful injection for thread-worms, for leucorrhœa, and for gleet.

5. Calcii Phosphas. — Calcium Phosphate. $Ca_3(PO_4)_2$. *Synonym.*—Phosphate of lime.

SOURCE.—May be made by the interaction of calcium chloride with sodium phosphate and excess of ammonia at a boiling temperature.

CHARACTERS.—A light white amorphous powder, insoluble in water.

Dose, 5 to 15 gr.—3 to 10 decigrms.

It is contained as a diluent in Pulvis Antimonialis and Extractum Euonymi.

Preparation.

Syrupus Calcii Lactophosphatis. Calcium lactate, 75; concentrated phosphoric acid, 45; refined sugar, 700; orange flower water of commerce undiluted, 25; distilled water to make 1000. Contains calcium phosphate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

ACTION AND THERAPEUTICS OF CALCIUM PHOSPHATE.

Calcium phosphate is a most important constituent of bones, and therefore it is necessary that food should contain it. If not the bones become soft. Calcium salts are abundant in milk, yolk of eggs, vegetables, and the bones that carnivora eat. They are absorbed from the intestine, and excess is excreted into the intestine and passed with the fæces.

Calcium phosphate has been given for rickets, and for the anæmia and feebleness often seen in young children, but it is not certain that it does any good; nor indeed is it likely to, for in rickets the defect is not a lack of calcium salts, but an inability of growing bone to use them. It may be given to pregnant and suckling women in order to provide the child with sufficient calcium salts for its bones.

It is used as a diluent for powders, as it is inert and it prevents their agglutination. For thes reasons, and because it is insoluble, it is a usefu constituent of pills containing essential oils.

The Syrupus Calcii Lactophosphatis is wit many a favourite preparation for phthisis and othe conditions of anæmia and weakness.

6. Calx Sulphurata.—Sulphurated Lime. A mi ture containing much calcium sulphate, some carbon, an not less than 50 per cent. of calcium sulphide CaS.

Source.—Obtained by heating a mixture of calciu sulphate and wood charcoal.

Characters. A grey white powder, with a peculiar sme

Dose, ¼ to 1 gr. in a pill **16 to 60 milligrms.**

Therapeutics of Calx Sulphurata.

It has been given internally in cases of suppur tion, but it probably has no influence on the proces Lately it has been used for various glandular e largements, and also for inflammatory process induced by influenza.

7. Calcii Chloridum. Calcium Chlori $CaCl_2$.

Source.—Obtained by neutralizing hydrochloric acid w calcium carbonate and evaporating.

Characters. White masses, having a great affinity water, and so deliquescent that they cannot be easily weigh The drug should be kept in solution. Soluble in its own weig of water.

Dose, 5 to 15 gr.—3 to 10 decigrms.

8. Calcii Lactas. Calcium lactate, $Ca(C_3H_5O$ $5H_2O$.

Source.—Obtained by neutralizing dilute lactic a with calcium carbonate and evaporating.

Characters. A white powder; almost tastele Soluble in 18·5 parts of water.

Dose, 10 to 30 gr.—6 to 20 decigrms.

THERAPEUTICS OF CALCIUM CHLORIDE AND LACTATE.

Outside the body calcium salts increase the rate of coagulation of the blood, and calcium chloride and lactate have therefore been recommended for hæmoptysis, hæmophilia, and other forms of hæmorrhage, and also for aneurysm. As jaundiced patients often bleed profusely, these salts are given before operations on them. They have been given for chilblains. Probably the dose of calcium salts necessary to affect the coagulability of the blood is so large that these salts are of no use given therapeutically, and certainly in practice they often fail. The lactate and the chloride are both nasty, and should therefore be given with liquorice or other strong flavouring agents.

Calcium chloride used to be given with the object of reducing enlarged lymphatic glands, but is not now employed.

9. Calx Chlorinata, *see* Chlorine.

10. Calcii Hypophosphis, *see* Phosphorus.

BARIUM.

Symbol, Ba. Atomic weight, 137·3 (Not official.)

Barii Chloridum. Barium Chloride. $BaCl_2,2H_2O$.

CHARACTERS. - Colourless, translucent tables.

It is in the Appendix of the Pharmacopœia, as an aqueous solution, used for testing, but it may be given internally.

Dose, $\frac{1}{2}$ to 2 gr. 3 to 12 centigrms.

ACTION.

Barium salts cause the cardiac contractions to become slower and more forcible, acting like digitalis. The blood-vessels all over the body, including those of the lungs, are constricted by direct action on their muscle, and blood-pressure rises: the bronchioles too are constricted. The plain muscular fibres of the intestine may be excited, and their peristalsis being increased diarrhœa ensues. In these respects barium resembles ergot as well as digitalis. It acts like veratrine

when applied locally to voluntary muscles, prolonging th
contraction; but this effect is done away with by the applica-
tion of potassium salts.

THERAPEUTICS

Barium chloride is not often given, but it has been us
for mitral insufficiency accompanied by irregularity of th
heart, for hæmorrhage, and as a stimulant in atony of th
bladder or intestine. Formerly it was given in nervo
diseases. The waters of Llangammarch wells contain 6
grains per gallon of barium chloride and have been used i
cardiac cases.

Barium Sulphide (not official), from ½ to 3 part
with wheat starch 3 parts, made into a cream with wate
spread on the skin, left for five or ten minutes, and then r
moved with a blunt knife, forms a good depilatory.

TOXICOLOGY.

Poisonous doses of barium salts cause salivation, thir
vomiting, purging, difficulty of breathing, a slow pulse, an
from their ultimate action on the spinal cord, paralysis of th
limbs. The heart is arrested in systole.

MAGNESIUM.

Symbol, Mg. Atomic weight, 24·32. (Not official.)

1. Magnesii Sulphas. Magnesium Sulpha
$MgSO_4,7H_2O$. *Synonym.*—Epsom salts.

SOURCE. It may be obtained from dolomite (native ca
bonate of calcium and magnesium), or magnesite (nati
magnesium carbonate), by the action of sulphuric ac
or by purifying the native sulphate.

CHARACTERS. Minute colourless rhombic prisms v
like zinc sulphate, but moister, and of a bitter taste, wh
that of the zinc salt is metallic. *Solubility.* 1 in 1 of c
water.

INCOMPATIBLES. Alkaline carbonates, phosphoric ac
phosphates, lime water, lead acetate, and silver nitrate.

IMPURITIES.—Lime and iron.

Dose, 30 to 90 gr.—**2 to 6 grms.**—for repea
administration, ¼ to ½ **oz.**—**8 to 16 grms.**—for single
ministration.

Preparation.

Mistura Sennæ Composita. — Magnesi
sulphate, 1 oz. in 4 fl. oz. *See* Senna.

2. Magnesii Sulphas Effervescens.—Effervescing Magnesium Sulphate.

SOURCE.—Dry 500 of magnesium sulphate till it has lost 23 per cent. of its weight. Then mix with it sodium bicarbonate, 360; tartaric acid, 190; citric acid, 125; refined sugar, 105. Heat the mixture till it aggregates, and stir till it assumes a granular form.

CHARACTERS.—White granules which effervesce on the addition of water.

Dose, 60 to 180 gr.—4 to 12 grms.—for repeated administration; for a single administration ½ **to 1 oz.—16 to 32 grms.**—in 3 to 6 fl. oz. of water.

3. Magnesii Carbonas Ponderosus.—Heavy Magnesium Carbonate. $(MgCO_3)_3,Mg(OH)_2,4H_2O$.

SOURCE.—Mix strong boiling aqueous solutions of magnesium sulphate and sodium carbonate. Evaporate.

CHARACTERS.—A white granular powder, feebly soluble in water; 3½ times as heavy as the light carbonate.

IMPURITIES.—Lime, sulphates.

Dose, 5 to 20 gr.—3 to 12 decigrms.—for repeated administration. **30 to 60 gr.—2 to 4 grms.**—for a single dose.

Preparations.

Liquor Magnesii Bicarbonatis. *Synonym.*—Fluid magnesia. Carbonic acid gas under a pressure of three atmospheres is passed into a mixture of freshly prepared magnesium carbonate and distilled water. It is kept securely corked. *Characters.*—A clear effervescing fluid. *Strength.*—10 gr. of the carbonate in 1 fl. oz. or 2 grms. in 100 millilitres.

This is Liquor Magnesii Carbonatis, B. P. 1898.

Dose, 1 to 2 fl. oz.—30 to 60 mils.

Heavy Magnesium Carbonate is contained in Trochiscus Bismuthi Compositus.

4. Magnesii Carbonas Levis.—Light Magnesium Carbonate. $(MgCO_3)_3,Mg(OH)_2,4H_2O$.

SOURCE.—Made like the heavy carbonate, except that the solutions are mixed cold and boiled after mixture.

CHARACTERS.—A very light white powder. Partly amorphous, with slender microscopic prisms intermixed. Ver insoluble.

Dose, 5 to 20 gr. 3 to 12 decigrms.—for repeate administration; **30 to 60 gr. 2 to 4 grms.** for a singl dose.

5. Magnesia Ponderosa. Heavy Magnesi MgO. *Synonyms.* Heavy calcined magnesia, Heavy mag nesium oxide.

SOURCE. Heat the heavy carbonate to expel the CO_2.

CHARACTERS. A white powder, very insoluble in wate 3½ times as heavy as the light.

Dose, 5 to 20 gr. 3 to 12 decigrms.—for repeate administration; **30 to 60 gr.**—**2 to 4 grms.** for a sing dose.

6. Magnesia Levis.—Light Magnesia Mg *Synonyms.* Light calcined magnesia, Light magnesium oxid

SOURCE. Heat the light carbonate to expel the CO_2.

CHARACTERS.—A light bulky white powder, feebly solubl

Dose, 5 to 20 gr. 3 to 12 decigrms.—for repeated a ministration; **30 to 60 gr. 2 to 4 grms.** for a single dos

Pulvis Rhei Compositus contains heavy or light magnesi

ACTION OF MAGNESIUM SALTS.

External.—None.

Internal. *Stomach and Intestines.* Magnes and the magnesium carbonate are antacid, acting many ways like the potassium and sodium alkalie The carbonic acid given off, if the carbonate has bee given, is sedative to the stomach. They are bo decomposed by the gastric juice, the chloride, lacta and bicarbonate of magnesium being formed. The three salts, or the sulphate if that has been tak act in the intestine as typical **saline purgativ** The sulphate is most powerful and is one of the b of saline purgatives for the intestinal cells havi very little selective action for either ion, the dru according to most authorities, acts almost entirely osmosis (*see* p. 97).

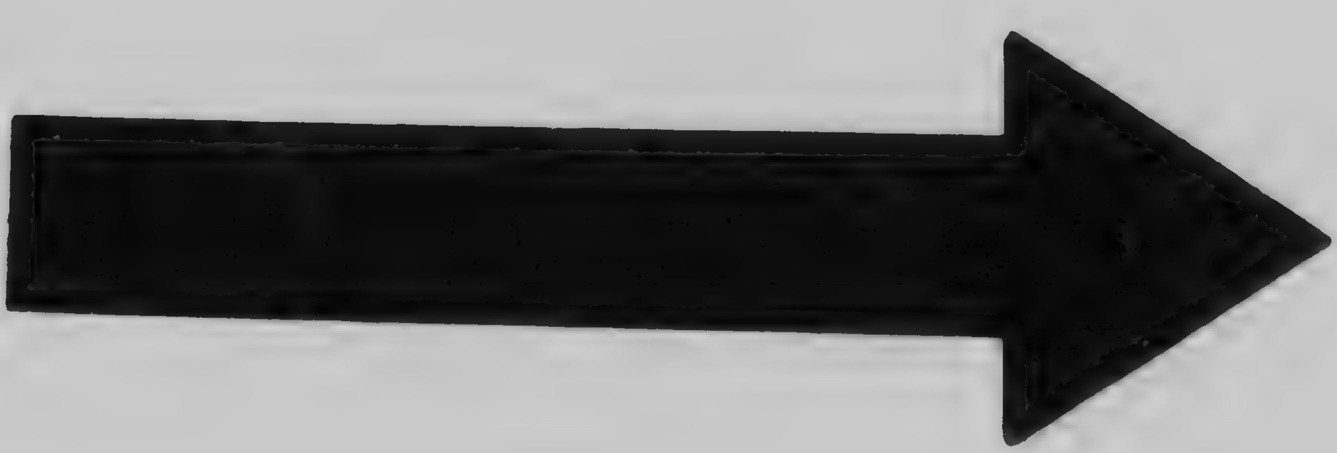
Blood and Urine.—Like other alkaline remedi these magnesium salts increase the alkalinity of t blood, alkalize the urine, help to keep uric acid solution, and are diuretic. But their action on the blood and urine is feebler than that of salts of potassium and sodium, for they are with difficulty absorbed. Large doses injected into the blood of animals are toxic, killing by action on the heart.

THERAPEUTICS OF MAGNESIUM SALTS.

Internal.—*Stomach.* Magnesia and the carbonate are mild alkaline remedies, and may be used in the same class of cases as other alkalies. They form insoluble compounds with mineral acids, oxalic acid, and salts of mercury, arsenic, and copper. By alkalizing the gastric contents they hinder the absorption of alkaloids. They are therefore antidotes to all these substances; the objection to them is their bulk. Magnesia is to be preferred, as the carbonate gives off carbonic acid gas. They must be freely given. The sulphate is an antidote to lead and barium salts, forming insoluble sulphates.

Intestines.—The magnesium salts are very common purgatives. Magnesia, the carbonate, and fluid magnesia are excellent for children. The sulphate is one of our best saline purgatives. It is very largely used, especially for the varieties of constipation that are associated with hepatic disorder, gout, or excessive uric acid. Its use is then spread over some time, and it may conveniently be taken as one of the mineral waters which contain it and sodium sulphate (*see* p. 146). A concentrated solution, causing as it does greatly increased secretion of intestinal fluid, is a useful purge for dropsy or ascites. Given every hour for a day it is an excellent drug for clearing out the bowels in bacillary dysentery.

Blood and Kidneys.—So little of these salts is absorbed, that they are only to be given for their alkaline effects on the blood and urine in those cases of gout and uric acid gravel in which potassium or sodium salts cannot be borne.



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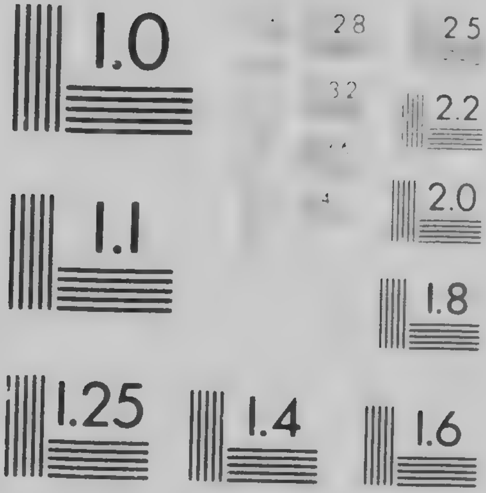


APPLIED IMAGE Inc

GROUP IV.

Plumbum, Argentum, Zincum, Cuprum, Bismuthu
Aluminium.

The pharmacopœial **salts** of these metals are **powerf** **astringents.** **Many** of them have some **salts** which a **emetics,** and others which, when applied locally, are **caust**

PLUMBUM.

Lead. Symbol, Pb. Atomic weight, 207·1. (Not offici

1. Plumbi Oxidum. Lead oxide. PbO. *Synony* Litharge.

Source.—Made by roasting lead in air.

Characters. Pale brick red heavy scales. Insoluble water, soluble in nitric and acetic acids.

Impurities.—Copper, iron, carbonates.

Preparation.

Emplastrum Plumbi. This is LEAD OLE and is sometimes called lead soap. Lead oxide, 4 boiled in water, 4, and olive oil, 8 (glyceryl olea $3PbO + 3H_2O + 2(C_3H_5.3C_{18}H_{33}O_2) = 3(Pb2C_{18}H_{33}O_2)$, oleate, $+ 2(C_3H_5.3OH)$, glycerin.

Emplastrum Plumbi is contained in Empla Hydrargyri, Resinæ, and Saponis.

2. Plumbi Acetas. Lead Acetate. $Pb(C_2H_3$ $3H_2O$. *Synonym.*—Sugar of lead.

Source.—Dissolve lead oxide or lead carbonate in ac acid and water.

Characters. White small monoclinic prisms, slig efflorescent and of a sweet taste. *Solubility.*—10 in 2 water.

Incompatibles.—Hard water, mineral acids and s alkalies, lime water, potassium iodide, vegetable astringe preparations of opium, and albuminous liquids.

Impurity.—Lead carbonate.

Dose, 1 to 5 gr.—6 to 30 centigrms.

Preparations.

1. Pilula Plumbi cum Opio.—Lead ace 80; opium, 12; syrup of glucose, 8. *Strength.*—1 cent. of opium.

Dose, 2 to 4 gr.—12 to 25 centigrms.

2. Suppositoria Plumbi Composita. — Lead acetate, 2·4; opium, 0·8; oil of theobroma, q.s. to make twelve suppositories. *Strength.*— Each contains 0·2 grm. (about 3 gr.) of lead acetate and 0·067 grm. (about 1 gr.) of opium.

Preparations made from the Acetate in which Lead exists as the **Subacetate**, $Pb_2O(C_2H_3O_2)_2$.

1. Liquor Plumbi Subacetatis Fortis.— Strong solution of lead subacetate. *Synonym.* Goulard's extract. Lead acetate, 250; lead oxide 175; water, 1000. A dense, clear, colourless liquid, sweet astringent taste, alkaline reaction. Sp. gr. 1·275. *Strength,* 24 per cent. of the subacetate.

2. Liquor Plumbi Subacetatis Dilutus. *Synonyms.*—Goulard water, Goulard's lotion. Liquor Plumbi Subacetatis Fortis, 12·5; water, 1000.

3. Glycerinum Plumbi Subacetatis. Strong solution of lead subacetate, 500; glycerin, 500; distilled water a sufficiency. Sp. Gr. 1·48.

4. Unguentum Plumbi Subacetatis. Strong solution of lead subacetate, 12·5; wool fat, 25; hard paraffin, 12·5; soft paraffin, 50.

3. Plumbi Iodidum.—Lead Iodide. PbI_2.

SOURCE.—Mix solutions of lead nitrate or lead acetate and potassium iodide and dry the precipitate.

CHARACTERS.—Heavy bright yellow powder or crystalline scales almost insoluble in water.

Preparation.

1. Unguentum Plumbi Iodidi. Lead iodide, 1; benzoated lard, 9. In India, benzoated suet may be used instead of benzoated lard.

ACTION.

External. The action of lead salts on the unbroken skin, if they have any, is very slight; but when applied to the abraded skin, to sores and to ulcers, they coagulate the albumen of the discharge, thus forming a protective coat; they coagulate the albumen in the tissues themselves; and they directly

not reflexly, contract the small vessels ; for these thre
reasons they are **powerfully astringent.** They als
soothe pain, and are therefore excellent local sedatives
It is obvious that substances so markedly astringen
will be **hæmostatics.** Any salt may be irritant an
caustic if enough is used and it is sufficiently con
centrated.

Internal.—Lead salts act on mucous membrane
precisely as on the broken skin, and are therefor
powerfully astringent and hæmostatic to all parts
the alimentary canal, from the mouth downward
In the stomach they are converted into a chlorid
Lead excites tonic contractions of unstriped muscl
hence the colic and abortion caused by it. (F
other actions *see* Toxicology.)

THERAPEUTICS.

External.—Lead salts are applied as lotions
ointments in many conditions for which an astri
gent, sedative effect is desired, as in weeping eczem
and many varieties of ulceration. The glycerin
the subacetate diluted fourfold with glycerin or mi
is very useful for these conditions. The lotions ma
be injected in vulvitis, leucorrhœa, gleet, and oto
rhœa, but should not be applied for ulceration
the cornea, lest the white precipitate formed shou
lead to permanent opacity. Their sedative effect
well seen in their use in pruritus, but of course t
cause of the itching should if possible be remove
The Liquor Plumbi Subacetatis Fortis is rarely use
as it is strong enough to irritate ; the dilute form
that usually employed when a lotion is desired. It
often applied to bruises when the skin is unbrok
but it is doubtful if it is absorbed. The ointment
the subacetate is an excellent remedy, and a loti
of lead and opium is a favourite preparation. It m
be made by mixing 5 gr. (3 decigrms.) of dried extr

pum with 1 fl. oz. (30 mils) of Liquor Plumbi subacetatis Dilutus and 1 fl. oz. (30 mils) of water. Diachylon ointment consists of equal parts of lead plaster and soft paraffin melted together, and mixed with an equal quantity of zinc oleate ointment and uric oleate ointment it forms a transparent ointment excellent for many purposes.

Internal.—The chief uses of lead salts (the acetate is the only one given internally) are as astringents in severe diarrhœa, such as that of typhoid fever, and as hæmostatics, as in gastric ulcer, or in hæmorrhage from the intestine, especially if severe, as in typhoid fever or tuberculosis. For these purposes the Pilula Plumbi c Opio is very valuable, and the suppositories may be employed for rectal hæmorrhage. Lead salts produce marked constipation. Other drugs are generally preferred, but the subacetate of lead may be used as a gargle, or painted as the glycerinum when an astringent effect on the mouth or pharynx is desired.

TOXICOLOGY.

ACUTE LEAD POISONING.—As when applied externally, so when taken internally, the salts of lead, if concentrated, are irritants. Cases of acute poisoning are rare. The acetate is most frequently taken. There is a burning, sweetish taste in the mouth, thirst, vomiting, abdominal colic, and usually constipation, but if the bowels are open the fæces are black; the skin is cold, and there is collapse. If the patient live long enough cramps in the legs, giddiness, torpor, coma, and convulsions are present. *Post mortem.*—The stomach and intestines show signs of irritant poisoning.

Treatment.—Give emetics (*see* p. 145), or wash out the stomach. Give sodium or magnesium sulphate to form an insoluble sulphate, and to open the bowels. If collapse is present stimulants and warmth should be used.

CHRONIC LEAD POISONING.—This is so common that it is fully described in text books on medicine. Among those who work in lead, it usually occurs because the dust in the air they breathe contains minute particles of lead compounds;

formerly it was thought that they generally were taken int
the body with food because the workers did not wash thei
hands before meals. Those who work at white lead factorie
are very liable to it. It has also occurred in many way
from the impregnation of food and water with lead, especial
from the storage of soft water in leaden cisterns and pipes.

Symptoms.– The earliest are constipation and intestina
colic. Lead is certainly absorbed, for it circulates in the bloo
and is excreted by the bowel and kidneys. It is suppose
to be taken up as an albuminate. After absorption
diminishes the amount of hæmoglobin and the numbe
of red blood corpuscles, and produces a sallow anæmia
it checks the separation of urates from the blood an
their excretion by the kidneys, hence gout is very common i
those poisoned by lead. As it circulates in the gums, an
the lead-impregnated plasma bathes their epithelium, throug
which some of the sulphur in the food and in the tartar of th
teeth has diffused, a lead sulphide is precipitated in the gum
and forms the well-known very dark blue line at the base
the teeth. For the same reason a blue line may occasional
be seen round the anus, and, after death, deposits of pi
ment in the intestines. Circulating in the nervous syste
lead very often produces chronic inflammation of the per
pheral nerves, especially those supplying the extensors of th
hand, and hence wrist-drop is a common symptom; but an
muscles, and sometimes almost all the muscles of the body, m
be paralysed from neuritis. It is noteworthy that the supinat
longus usually escapes. The sensory fibres of the nerves are n
often affected, hence pain and anæsthesia are rare; but pain
especially round the joints, may occur. In exceptional cases th
anterior cornua of the spinal cord waste, and lead often affec
the brain, causing saturnine lunacy, and also convulsions, know
as saturnine epilepsy. Inflammation of the optic nerve, or opt
neuritis, sometimes occurs, leading to blindness, which, howeve
may be present without any change in the nerve. The kidne
are often the seat of chronic inflammation; whether this is du
the passage of the lead through them, or to the gout caused
the lead, is an open question. The treatment consists chie
in avoidance of the source of poisoning. Potassium iodide
often given, as it is supposed to increase the excretion of le
in the urine. This is probably incorrect. Very little le
passes out by the urine; most leaves the body by the fæces.
is said also to be excreted in the bile, sweat, and milk. For
clinical account of the symptoms and treatment a text-book
medicine must be consulted.

ARGENTUM.

ver Symbol, Ag. Atomic weight, 107·93. (Not official.)

1. Argenti Nitras. Silver Nitrate. $AgNO_3$. *onym.*—Lunar caustic.

Source. Obtained by the interaction of silver and nitric .

Characters.—Colourless, tabular, right rhombic crystals *ility.*—2 in 1 of water. Should be kept in the dark, as ht blackens it.

Incompatibles. Alkalies and their carbonates, chlorides, i- except nitric and acetic), potassium iodide, solutions of rsenic, and astringent infusions.

Impurities.—Other nitrates.

Dose, ¼ to ½ gr.—16 to 30 milligrms.—in a pill with in.

2. Argenti Nitras Induratus. *Synonym.*—ened caustic.

Source.—Fuse together silver nitrate, 19 parts, and ium nitrate, 1 part, and pour into proper moulds.

Characters.—White or greyish-white cylindrical rods or Freely soluble in water.

3. Argenti Nitras Mitigatus. *Synonym.*—ated caustic.

Source.—It is a mixture made by fusing together one t of silver nitrate and two parts of potassium nitrate. product is poured into moulds.

Characters.—White or greyish-white rods or cones. y soluble in water.

Action.

External.—The action of silver salts is very like t of lead salts, but they are more powerful. refore silver nitrate is much used as a **caustic**, it does not act deeply; it is consequently an mirable agent when we wish a limited caustic ion on any particular part. Lotions of it may be d as **astringents**, but they are not so useful as d lotions, for they are more irritating and cause pain. Silver salts, like lead salts, are **hæmostati** acting in precisely the same way. Weak solutio of the nitrate stimulate to healthier action indole ulcers and other inflamed surfaces.

Internal. Silver salts, when locally applied the mucous membrane of the mouth, act as on t abraded skin. In the stomach the nitrate is deco posed, we do not know what compound is form but it is said to have no astringent action. Silv is absorbed from the alimentary tract, for its lon continued use leads to a permanent dark bluish-sla colour first of the lips, inside of the cheeks, gun nostrils, and eyelids, and later of the skin (argyri This colour is due to the deposition of minu granules of metallic silver. Very little is kno about its further action. In acute poisoning seve vomiting and nervous symptoms, as convulsions, a met with; the chronic form, seen more often wh silver was frequently prescribed internally, is sho by paralysis like that due to lead, albuminuria, a the discoloration above mentioned. Some is pass in the fæces as the sulphide; some is deposited in t internal organs, especially the kidney.

THERAPEUTICS.

External. Nitrate of silver is much used beca it is from its limited action one of the best caust and may be employed to destroy warts and exuber granulations, or to apply to bites; but it must remembered that it is of no use when an extensive deep action is required. Because of its combinat of an irritant stimulating effect with an astring influence, lotions of it, of generally about 5 gr. to fluid ounce of water, are of much benefit when plied as a paint to indolent ulcers, to bedsores, to affected parts in chronic pharyngitis or laryng as an injection in gleet or inflammation of the uteri. A urethral bougie should contain ¼ gr. (16 milligrms.). Weaker solutions (2 gr., 12 centigrms., to 1 fl. oz., 30 mils) are employed for granular lids and various forms of ophthalmia. Solutions of the nitrate will sometimes relieve pruritus, and may be applied to the red skin of a threatening bedsore; very strong solutions have been recommended as a local application in erysipelas. Tinea tarsi is often treated by the application of solid silver nitrate, and ulcers of the mouth and other parts may be touched with it. It is an excellent hæmostatic for leech-bites. It is also applied to smallpox vesicles to prevent pitting, to boils, and to the uterus in chronic cervical catarrh. Protargol, a protein compound containing 8 per cent. of silver, readily soluble in water, is used as an injection for gonorrhœa. The usual strength is 1 per cent. Largin is a somewhat similar silver-protein compound.

Internal. Silver salts are not much used internally, and their continuous employment is objectionable on account of the argyria produced. They were formerly often given in nervous diseases, but there is no evidence that they did any good. Although it is said that the compound of silver formed in the stomach is non-astringent, nitrate of silver will certainly check severe diarrhœa, especially that of children. Sixty grains of nitrate of silver dissolved in two pints of tepid water, and injected high up the rectum, have been used with great benefit in dysentery.

ZINCUM.

Zinc. Symbol, Zn. Atomic weight, 65·37. (Not official.)

1. Zinci Chloridum.—Zinc Chloride. $ZnCl_2$.

SOURCE.—Zinc chloride is prepared by the interaction of hydrochloric acid and zinc.

CHARACTERS.—Colourless opaque rods or tablets, very deliquescent and caustic. *Solubility.*—Freely solubie alcohol, ether, and water if a trace of acid is present.

IMPURITIES.—Iron, calcium, and sulphates

Preparation.

Liquor Zinci Chloridi. Granulated zinc, hydrochloric acid, 110; water, 100

ACTION OF ZINC CHLORIDE.

External.—It is very **caustic**, penetrating deep and limited in its effect to the seat of applicati It is strongly **antiseptic**, and a solution of it sp. gr. 2·0, known as Sir Wm. Burnett's fluid, used as a domestic antiseptic.

Internal, *see* Toxicology.

THERAPEUTICS OF ZINC CHLORIDE.

External. It is used as a powerful caustic, is often made into sticks with plaster of Paris destroy warts, nævi, condylomata, lupoid patch &c. For the same purposes it may be made int paste with equal parts of starch or flour. Either liquor, or Burnett's fluid, may be employed to w out bed-pans, closets, &c., but chloride of zinc is so commonly used as other antiseptics. It is given internally.

TOXICOLOGY.

Chloride of zinc is a corrosive irritant poison, causi sensation of burning in the mouth and throat, abdominal p vomiting—the vomit containing blood, mucus, and shred mucous membrane violent purging, and collapse. *mortem.* The appearances are those produced by an a irritant.

Treatment.—Wash out the stomach, or give emetics p. 145), and then demulcents (*see also* p. 145).

2. Zinci Sulphas.—Zinc Sulphate. $ZnSO_4,7$

SOURCE.—Made by the interaction of zinc and sulph acid.

CHARACTERS.—Minute colourless prisms, very like phate of magnesium, but having a metallic taste. *So lity.*—10 in 7 of water.

IMPURITIES.—Lead, iron, copper, arsenic.

INCOMPATIBLES.—Alkalies and their carbonates, lime water, lead acetate, silver nitrate, astringent vegetable infusions or decoctions, and milk.

Dose, 1 to 3 gr.—6 to 20 centigrms. (tonic); **10 to 30 gr.—6 to 20 decigrms.** (emetic).

Preparation.

Unguentum Zinci Oleatis. Dissolve zinc sulphate, 50 grms., in distilled water, 60 millilitres; also dissolve 90 grms. of hard soap in shavings in 600 millilitres distilled water. Mix the two solutions. Collect the zinc oleate; dry it and add an equal weight of white soft paraffin.

3. Zinci Carbonas. Zinc Carbonate. Zinc hydroxycarbonate.

SOURCE. Boil together solutions of zinc sulphate and sodium carbonate. Dry the precipitated zinc salt.

CHARACTERS. A white tasteless powder, insoluble in water. Similar in constitution to magnesium carbonate.

IMPURITIES. Sulphates, chlorides, copper.

Rarely used except to make the oxide and the acetate.

4. Zinci Oxidum. Zinc Oxide. ZnO.

SOURCE.—Prepared from metallic zinc by combustion in

CHARACTERS.—A soft, nearly white, tasteless powder. Insoluble in water.

IMPURITIES.—The carbonate and its impurities.

Dose, 3 to 10 gr. 2 to 6 decigrms.

Preparation.

Unguentum Zinci.—Zinc oxide, 15; benzoated lard, 85. In India benzoated suet should be used instead of benzoated lard.

5. Zinci Oleostearas.—Zinc Oleostearate.—Hard soap, 2; curd soap, 1; zinc sulphate, 1; water a sufficiency. Made by mixing a solution of the soaps with one of the sulphate of zinc.

CHARACTERS.—A white amorphous powder insoluble in water and alcohol.

6. Zinci Acetas. Zinc Acetate. $Zn(C_2H_3O_2)_2.2H$

SOURCE.—Dissolve the zinc carbonate in acetic acid a water, and boil. Zinc acetate crystallizes out.

CHARACTERS.—Thin, translucent, colourless, crystalli plates, with a pearly lustre and a sharp taste. *Solubility.*- 10 in 25 of water.

IMPURITIES.—Those of the carbonate.

INCOMPATIBLES.—The same as of the sulphate.

Dose, 1 to 2 gr. 6 to 12 centigrms.

7. Zinci Valerianas. — Valeriana Rhizoma.

ACTION OF ZINC SULPHATE, CARBONATE, OXID OLEOSTEARATE, AND ACETATE.

External. These salts, when applied to th broken skin or an ulcerated surface, are all **astri gents,** acting by precipitating the albumen in th discharge and also that in the tissues. Thus the resemble lead and silver salts, but as a whole th are less powerfully astringent. The most active them are the sulphate and acetate, whilst the ca bonate and oxide are very weak. All these zinc sal are mild hæmostatics.

Internal. *Alimentary canal.*—They all have astringent effect on the gastric and intestinal muco membranes. The sulphate, and to a less degree t carbonate, in doses of about 20 grains (12 decigrm are prompt **emetics.** They act directly on t stomach, and have the advantage of producing ve little depression.

Remote effects.—Very little is known about t remote action of zinc salts, nor do we know h they act on the blood. It has been stated that th are depressant to the nervous system as a whole, a that they act as remote astringents, and will the fore arrest hæmorrhage from the uterus, kidneys, & but this statement is probably incorrect. The p longed administration of zinc salts causes sympto like those of lead poisoning. Probably the sympto which those who work with zinc sometimes complain are due to arsenic and other metals which contaminate compounds of zinc.

THERAPEUTICS OF ZINC SULPHATE, CARBONATE, OXIDE, OLEOSTEARATE, AND ACETATE.

External. A solution of the sulphate, generally of 2 gr. (12 centigrms.) to 1 fl. oz. (30 mils), usually coloured red with compound tincture of lavender, and then called Lotio Rubra, is very often used for its astringent effect to all sorts of raw surfaces and ulcers, and as an injection in gonorrhœa, leucorrhœa, vulvitis, or otitis. Plain solutions of this strength may be applied to the eye for conjunctivitis. A urethral bougie should contain a grain; sometimes a grain of the alcoholic extract of belladonna is added. The oleostearate is an excellent application to sores and ulcers when a less astringent preparation is required; and the oxide and carbonate, either dusted on the parts or used as an ointment, are in constant use for cases in which only a mild astringent effect is desirable. An ointment, often known as Unguentum Metallorum, consists of equal parts of ointments of zinc oxide, lead acetate, and dilute mercuric nitrate. This is a very good application for many varieties of eczema, sores, and ulcers. Equal parts of zinc oleostearate, mercuric oxide, and diachylon ointment (p. 173) form an ointment which has the great advantage of being transparent, and therefore the progress of the disease can be observed without washing off the ointment. Calamine (impure zinc carbonate) is an excellent slight astringent for skin diseases. An ointment (1 to 5 of benzoated lard) and a lotion (prepared calamine, 15 gr. (1 grm.); zinc oxide, 15 gr. (1 grm.); lime water, 80 ♏ (5 mils); glycerin, 20 ♏ (12 decimils); water, 1 fl. oz. (30 mils), are good preparations. The following sometimes succeeds in pruritus: Zin oxide, 150 gr. (10 grms.); gelatin, 120 gr. (8 grms. glycerin, 6 fl. dr. (21 mils); water to 6 fl. o (180 mils). The jelly to be melted when used, an applied with a brush, and then covered with cotto wool.

Internal. *Alimentary canal.*—On account their disagreeable taste, solutions of zinc salts a not used as astringents to the mouth. Small dose of the oxide or sulphate may be given as astringen in diarrhœa. The sulphate is a very good emetic f cases of poisoning, for it acts promptly withou causing much nausea and hardly any depressio It is occasionally given as an emetic to childr suffering from laryngitis or bronchitis.

Remote effects.—Because it is believed to act a depressant to the nervous system, zinc sulpha has been given in hysteria, epilepsy, whoop cough, and chorea in doses of 1 to 3 grains (6 20 centigrms.) thrice a day. It has been prescribe much for chorea, but often its effect is so slow th it is difficult to prove that the patient would n have improved quite as rapidly without any dru It is usually said to be a tonic, but there is n trustworthy evidence for this statement. The oxid given internally will occasionally check the nigh sweats of phthisis.

CUPRUM.

Copper. Symbol, Cu. Atomic weight, 63·57. (Not official

Cupri Sulphas. Copper Sulphate. $CuSO_4,5H$
Synonyms.—Blue vitriol; Blue-stone; Cupric sulphate.

Source.—Obtained by the interaction of water, cup oxide or copper, and sulphuric acid.

Characters.—Deep blue crystals in triclinic prisms. Tas styptic. *Solubility.*—1 in 3·5 of water. Solution strongly ac

Impurity.—Iron.

INCOMPATIBLES.—Alkalies and their carbonates, lime water, mineral salts (except sulphates), iodides, and most vegetable astringents.

Dose, ¼ to 2 gr.—16 to 120 milligrms. (astringent); 5 to **10 gr.—3 to 6 decigrms.** (emetic)

ACTION.

External.—In the solid form copper sulphate is, when applied to raw surfaces, a powerful **caustic**. In dilute solutions it is **astringent**, acting like zinc sulphate, but more powerfully. Copper salts are strongly antiseptic.

Internal.—*Alimentary canal.*—Here also, if very concentrated or given in large doses, copper sulphate is an acute caustic irritant, but poisoning by it is very rare. In medicinal doses it is strongly **astringent**. Five to ten grains of the sulphate form a powerful **emetic**, acting directly on the stomach. As it is more irritating than zinc sulphate, it acts more readily, but it has the disadvantage that, if it fails to act, the stomach must be promptly emptied by some other means, for if not the copper sulphate will cause inflammation of it.

Remote effects.—Copper salts are slowly absorbed, and copper is chiefly re-excreted by the liver in the bile.

THERAPEUTICS.

External.—The sulphate is applied as a caustic to reduce exuberant granulations, and is used for granular tarsi, being rubbed on the edges of the lids; as it is milder than nitrate of silver, it causes less pain. The "lapis divinus," which is often used for this last purpose, consists of copper sulphate 3 oz. (100 grms.), potassium nitrate 3 oz. (100 grms.), alum 3 oz. (100 grms.), camphor 60 gr. (4 grms.). The first three are fused together. The camphor is added, and the mass is cast into cylindrical moulds.

Lotions of copper sulphate, usually about 2 g
(12 centigrms.) to 1 fl. oz. (30 mils), may be appli
as astringents for just the same purposes as lotions
zinc sulphate: but it must be remembered that th
are more powerful. This is the usual strength f
solutions which are to be dropped into the ey
Rather stronger solutions are mild hæmostatics.

Copper oleate made, with lanolin, into an oin
ment of a strength of 10 to 20 per cent. is an exce
lent parasiticide for ringworm.

Internal. In small doses copper sulphate
valuable for severe diarrhœa; usually it is given
the mouth in the form of a pill, but it may be giv
as a rectal injection. It is a rapid emetic, and m
be employed in laryngitis and bronchitis in childre
and in cases of narcotic poisoning, for which it
useful on account of its prompt action. It is par
cularly serviceable in phosphorus poisoning, for if
is used copper is deposited on the phosphorus, re
dering it inert. It is usual to give three or fo
grains of the sulphate in water every few minut
till vomiting takes place. After emetic doses
copper sulphate there is generally only one act
vomiting, but by that the stomach is complet
emptied. Very little is known about the rem
action of salts of copper, but it was formerly stat
that the sulphate would cure chlorosis.

Toxicology

In sufficient doses salts of copper are violent gas-
intestinal irritants, but acute poisoning is very rare.

Copper may be taken in very small quantities for a lo
time without producing any ill-effects, for many pers
habitually consume, without harm, preserved vegetables,
green colour of which is due to preparation with copper.

It has been thought that coppersmiths are particula
liable to phthisis, but they are not more prone to it than
followers of other dusty trades. Workers in brass may su
from anæmia, a green line on and at the bases of the tee
wasting, weakness, dyspepsia, tremors, headache, vague pai

yngeal and laryngeal catarrh with occasional hæmoptysis phonia, and profuse secretion of sweat which may be These symptoms are thought to be due to the copper ned in brass. Sometimes colic is due to the contamina f copper and brass by lead.

BISMUTHUM.

th. Symbol, Bi. Atomic weight, 208·0. (Not official.)

1. Bismuthi Carbonas. Bismuth Oxycarbonate. $O_2CO_3).H_2O$. *Synonym.*—Bismuth subcarbonate.

SOURCE.—It may be prepared by the interaction of bis nitrate and ammonium carbonate.

CHARACTERS.—A heavy white powder, insoluble in water.

IMPURITIES.—As of the subnitrate.

Dose, 5 to 20 gr. 3 to 12 decigrms.

Preparation.

Trochiscus Bismuthi Compositus. Bismuth oxycarbonate, 0·15 grm.; heavy magnesium carbonate, 0·15 grm.; precipitated calcium carbonate, 0·3 grm.; and a rose basis.

2. Bismuthi Subnitras.—Bismuth Oxynitrate. $ONO_3.H_2O$.

SOURCE.—Prepared by the interaction of bismuth nitrate d water.

CHARACTERS.—A heavy white powder in minute crystalline Insoluble in water, but soluble in dilute nitric acid.

INCOMPATIBLES.—With water it always yields a little free d hence leads to the liberation of carbonic acid gas from ate of sodium, or if prescribed with potassium iodide to the liberation of iodine. Bismuth salts form tannate of th when prescribed with substances containing tannin.

IMPURITIES.—Lead, arsenic, tellurium, chlorides, nitrates.

Dose, 5 to 20 gr.—3 to 12 decigrms.

Preparation.

Liquor Bismuthi et Ammonii Citratis. *Synonym.*—Liquor Bismuthi.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

3. Bismuthi Salicylas. Bismuth Salicylate or muth Oxysalicylate. $BiOC_7H_5O_3$.

SOURCE.—May be prepared by the interaction of bismuth and sodium salicylate.

CHARACTERS AND TESTS.—A white or nearly white hea
amorphous powder insoluble in water, alcohol, and glycer
It gives the reactions for bismuth and a violet colour w
ferric chloride.

Dose, 5 to 20 gr.—3 to 12 decigrms.

ACTION.

External.—Salts of bismuth have no action
the unbroken skin. Dusted on a raw surface th
form a protecting coat, are feebly **germicidal**, a
are very **mildly astringent**.

Internal.—If large doses of salts of bismuth
injected under the skin of animals, or if large do
of soluble salts are given to them by the mou
they produce effects as severe as those due to an
mony. The chief are gastro-intestinal irritation a
fatty degeneration, and it is stated that some v
susceptible persons may be poisoned by large do
by the mouth of insoluble salts; but, as a rule, a
symptoms of gastro-intestinal irritation caused by
insoluble salts of bismuth are due to the arsenic w
which bismuth salts, especially the subnitrate, may
contaminated. When pure, it is probable that th
salts, like any bland heavy powder, act chiefly as p
tectives to the gastro-intestinal mucous membra
They have an **astringent** action, diminishing secreti
and are gastro-intestinal antiseptics. The subnitrat
believed to be the most powerful in the last direct
because in contact with water it tends to split
into bismuth oxide and nitric acid, and in
intestine bismuth sulphide is formed, and nitr
vapours, which are antiseptic, are liberated, bu
may be that it acts as an oxygen carrier like arse
for the oxide certainly appears to act in this w
Bismuth is very slowly absorbed and excreted chi
in the urine, and it may be found in the liver,
neys, spleen, and nervous system. Nothing cer
is known of any remote effects. Bismuth lea

the rectum as the sulphide, and colours the fæces black. It may cause a purplish line on the gums. The breath of persons taking salts of bismuth occasionally has an odour like onions. This is due to contamination of the bismuth with minute traces of tellurium.

THERAPEUTICS.

External.—Salts of bismuth may be dusted on [illegible] as protectives and mild astringents; for this purpose the oxychloride, much used as a cosmetic blanc de perles, is the best. The following is a good bismuth ointment:—Bismuth oxide 1 part, and oleic acid 8 parts, stirred in with 3 parts of white wax melted by heat, with 9 parts of soft paraffin. The subnitrate is sometimes snuffed up the nose during [illegible], and suspended in mucilage it may be used as an injection for gonorrhœa or leucorrhœa. Dermatol, which is bismuth subgallate, has been employed as an ointment and dusting powder.

Internal.—The subnitrate and the carbonate are chiefly employed, and they seem to be more efficacious than the soluble preparations. They must be suspended, preferably by means of compound tragacanth powder (not acacia, for with this a compact mass is formed at the bottom of the bottle); given thus they are more efficacious than as a lozenge. It is not known how the effect is produced, but the use of these salts is remarkably efficient in relieving gastric pain, whether due to ulcer or to [illegible], or even when no cause can be detected. The usual dose is 10 or 20 gr. (6 to 12 decigrms.). [illegible] these drugs will often stop vomiting due to [illegible], gastric ulcer, chloroform, pregnancy, or [illegible] any other cause. For their astringent action they are given in diarrhœa, doses of 60 gr. (4 grms.) [illegible] administered without any ill effect, and some believe that part of the benefit is due to the a septic action of bismuth salts. They appear so times to check the severe diarrhœa of tubercu ulceration of the bowel. Their efficacy as ga anodynes and as gastric astringents is much incre by combination with a little morphine, and if gi as gastric sedatives the addition of sodium bi bonate as well as the morphine is an advant In such a prescription the bismuth carbonat preferable to the subnitrate, for the latter may on the sodium carbonate and lead to the produc of sufficient carbonic acid to drive the cork ou the bottle. Many think the insoluble oxychlo (dose, 5 to 20 gr., 3 to 12 decigrms.) a more u preparation than the subnitrate or the carbonate

The salicylate has been largely used in va gastric affections. It is supposed to combine virtues of bismuth salts with the antiseptic act of salicylic acid. It easily splits up, and is there best given in cachets, but the following is a u prescription for summer diarrhœa and choler Salicylate of bismuth, 5 gr. (3 decigrms.); compo powder of cinnamon, 7½ gr. (5 decigrms.); pound tincture of chloroform (B. P. 1885), 2 (12 decimils); aromatic spirit of ammonia, 20 ɱ decimils); essence of peppermint, 10 ɱ (6 decim chalk mixture to 1 fl. oz. (30 mils). To be t every three or four hours.

ALUMINIUM.

Symbol, Al. Atomic weight, 27·1. (Not official.)

1. Alumen Purificatum. Purified alu sulphate of aluminium and potassium (potassium a $Al_2(SO_4)_3,K_2SO_4,24H_2O$, or a sulphate of aluminium ammonium (ammonium alum), $Al_2(SO_4)_3,(NH_4)_2SO_4,24H$

Source.—Made by the combination of aluminium phate with potassium sulphate or with ammonium sulp

Characters.—Acid, transparent, colourless crystalline masses, with a sweetish astringent taste. *Solubility.*—1 in 10 of cold water; 1 in 4 of glycerin.

Incompatibles. Alkalies, lime, salts of lead, mercury, and iron, tartrates, and tannic acid.

Impurities. Iron sulphate and silicates.

Dose, 5 to 10 gr. – 3 to 6 decigrms.

Preparation.

Glycerinum Aluminis. Purified alum, 20; distilled water, 7·5; glycerin to produce 120·0.

2. Alumen Exsiccatum. Exsiccated alum.

Source. Heat potassium alum till no more aqueous water is given off. It contains 45 per cent. less water than alum.

Characters. A white powder or spongy masses. *Solubility.* Slowly but completely soluble in water.

3. Kaolinum. Kaolin.

A native aluminium silicate powdered and freed from gritty particles.

Character. A soft white powder. *Solubility.* – Neither in water nor dilute acids.

It is contained in Pilula Phosphori.

Action of Alum.

External. It has no action on the unbroken skin, but coagulates the albumen of the discharges from ulcers, sores, &c., and thus forms a protecting covering to the parts, and acts as an efficient astringent. The albumen in the tissues themselves is coagulated also. This coagulated albumen will compress and occlude the vessels, and thus alum is hæmostatic. Dried alum absorbs water, and therefore its solid form is mildly caustic.

Internal. – *Alimentary tract.*—Alum is an excellent astringent for the mouth, stomach, and intestines, and will cause constipation. In large doses it

is **emetic**, acting directly on the stomach, and
larger still, irritant and purgative. Most, if not a
is passed by the fæces; probably, in medicinal dos
it has no remote effects on the tissues.

Nervous system.—Given to animals in lar
dose it produces paresis, loss of sensation, for
movements, drowsiness, and death from respirat
paralysis.

Therapeutics of Alum and Kaolin.

External. -Alum is occasionally used as a cau
to destroy weak exuberant granulations. Kaolin
a good dusting powder. Fuller's earth, also a nat
aluminium silicate, is used as a dusting powder.
cause of its astringency alum has many uses; it
for example, be applied to weeping eczematous
faces, and as an injection or soaked on lint for vulv
of children. Solutions of it have been used for leu
rhœa and gleet. Ten grains to the fluid ounce of wa
is a common strength for most purposes. Five gra
to the fluid ounce make a good eye wash or a gar
Strong solutions or powdered alum applied loc
stop bleeding, if it is not severe, such as occ
from piles, leech-bites, slight cuts, the gums,
the nose. Alumnol, an aluminium salt of napht
sulphonic acid, is very soluble. It forms an ex
lent lotion or ointment for raw surfaces.

Kaolin resists most chemical reagents, and th
fore it is used as a basis for making pills of
bodies as phosphorus, silver nitrate, or potass
permanganate, for with them chemical reac
would occur if an ordinary basis were used.

Internal. — *Alimentary canal.* — As a m
wash or gargle (5–10 gr. to 1 fl. oz., 3–6
grms. to 30 mils) alum is very valuable in ul
tive stomatitis, in aphthous conditions of
mouth, and in slight pharyngitis or tons

Glycerinum Aluminis painted on with a camel's-[illegible] brush is excellent for these conditions. If the [illegible] be irrigated with a solution of alum it may [illegible] a chronic ozæna. It has been found that [illegible] astringents are preferable for bleeding from [illegible] stomach and for diarrhœa, but a teaspoonful of [illegible] dissolved in simple syrup and given every [illegible] of an hour till vomiting is produced is an [illegible]ent emetic for children, and may be used to [illegible] vomiting in laryngitis and bronchitis, as it [illegible] depressant. Alum whey, obtained from milk [illegible] by alum, may be given in the diarrhœa of [illegible] fever. In lead colic alum may open the [illegible], probably because, being a sulphate, it precipitates any lead salts as insoluble sulphates.

GROUP V.

Iron and Manganese.

Some authorities consider that the action of these drug[illegible] somewhat similar.

IRON.

[illegible]m. Symbol, Fe. Atomic weight, 55·84. (Official.)

1. Ferrum. Annealed iron wire, diameter 0·1 milli[illegible] No. 35 wire gauge), or wrought iron nails, free from [illegible]

Metallic iron is pharmacopœial in two forms, viz. the [illegible] and reduced iron.

Preparation.

Vinum Ferri. *Synonym.* Steel wine. Iron wire, 1; sherry, 20.

Dose, 1 to 4 fl. dr.—4 to 16 mils.

2. Ferrum Redactum. Reduced Iron. A fine [illegible] containing not less than 80 per cent. of metallic iron [illegible] variable amount of iron oxide.

[illegible]. Ferric hydroxide is heated in a gun-barrel, and by having hydrogen passed over it.

Characters.—A greyish-black powder, strongly attracted by the magnet.

Impurity.—Sulphur.

Dose, 1 to 5 gr.—6 to 30 centigrms.

Preparation.

Trochiscus Ferri Redacti. *Strength.* 0·0 grm. or 1 gr. of reduced iron in each with a simpl basis.

The following (viz. the sulphate, the saccharated carbo ate, the saccharated phosphate, and the iodide) *are ferr salts*: that is to say, salts of the lower oxide of iron, FeO The iodide is not itself official, but a preparation containing it i

3. Ferri Sulphas. Ferrous Sulphate. $FeSO_4,7H$

Source.—Iron wire is dissolved by boiling in sulphur acid and water. The sulphate is crystallized out.

Characters.—Pale green, oblique rhombic prisms, with styptic taste. *Solubility.*—1 in 1½ of water.

Impurities.—Per-salts of iron, copper.

Dose, 1 to 5 gr.—6 to 30 centigrms.

Preparation.

Mistura Ferri Composita. *Synonym.* "Griffith's mixture." Ferrous sulphate, 6; potassiu carbonate, 8; myrrh, 15; glucose, 15; gum acac 15; spirit of nutmeg, 10; rose water, to 1000. It i dark green mixture containing the iron carbonate, f the iron sulphate and the potassium carbonate act each other.

Dose, ½ to 1 fl. oz.—15 to 30 mils.

4. Ferri Sulphas Exsiccatus.—Exsiccat Ferrous Sulphate. Contains not less than 77 per cent. pure anhydrous ferrous sulphate $FeSO_4$.

Source.—Ferrous sulphate is deprived of part of water of crystallization

Characters.—A dirty white powder which easily abs water, and therefore pills made of it may spoil. 2½ gr. = 4 of the sulphate.

Dose, ½ to 3 gr.—3 to 20 centigrms.

Preparations.

1. **Pilula Ferri.** *Synonym.*—Blaud's pill. Exsiccated ferrous sulphate, 33; exsiccated sodium carbonate, 21; gum acacia, 5; tragacanth, 2; glycerine, 31; water, a sufficiency. The pill contains 22·5 per cent. of ferrous carbonate, the same chemical change taking place as in Mistura Ferri Composita.

Dose, 5 to 15 gr. 3 to 10 decigrms.

2. **Pilula Aloes et Ferri**, *see* Aloes.

5. **Ferri Carbonas Saccharatus.** Ferrous carbonate, more or less oxidized and mixed with glucose. It contains not less than 50 per cent. of ferrous salt calculated as ferrous carbonate, $FeCO_3$.

CHARACTERS. Greenish brown powder of a sweetish taste. It is a very unstable compound, being easily oxidized. The sugar in both this preparation and in Blaud's pill forms a coating and prevents further oxidization. The saccharated carbonate of iron should not be given in a mixture, for the sugar is dissolved out, and then the compound can oxidise.

IMPURITIES.—Ammonium sulphate, excess of iron oxide.

Dose, 10 to 30 gr. 6 to 20 decigrms. in a cachet [illegible]

6. **Ferri Phosphas Saccharatus.** Saccharated Iron Phosphate. It contains not less than 60 per cent. of ferrous salts, mixed with glucose and calculated as ferrous phosphate, $Fe_3(PO_4)_2,8H_2O$.

CHARACTERS.—A slate-blue amorphous powder, partly soluble in water. Taste sweetish.

IMPURITY.—Arsenic.

Dose, **5 to 10 gr. 3 to 6 decigrms.**

Preparation.

1. **Syrupus Ferri Phosphatis.** Dissolve iron wire, 8·6; in concentrated phosphoric acid, 62·5; syrup, 700; distilled water to 1000. *Strength.*—10 millilitres contain 0·18 grm. of anhydrous ferrous phosphate, 1 gr. in each fluid drachm.

Dose, $\frac{1}{2}$ to 1 fl. dr.—2 to 4 mils.

2. **Syrupus Ferri Phosphatis cum Quinina et Strychnina.** *Synonyms.*—Easton's Syrup. Syrupus

Trium Phosphatum. Iron wire, 8·6; **concentra** phosphoric acid, 62·5; powdered strychnine, 0·5 quinine sulphate, 14·8; syrup, 700; water to ma 1000. *Strength.*—10 millilitres contain 0·18 g anhydrous ferrous phosphate, 0·148 grm. of qui sulphate, and 0·0057 grm. of strychnine; 1 fl. dr tains 1 gr. anhydrous ferrous phosphate, [illegible] sulphate, and [illegible]

Dose, ½ to 1 fl. dr. 2 to 4 mils.

7. Syrupus Ferri Iodidi. Make a hot solu of iron wire and iodine in water and add to it glucose syrup. It is colourless. *Strength.* 10 millilitres cont 0·7 grm. of ferrous iodide; 1 fl. dr. contains 3·75 grs. T preparation is approximately two-thirds the strength of of B.P. 1898.

It is very liable to change, forming the oxyiodide of and free iodine, which makes it yellow. This alteration ca be prevented, but it may be retarded by adding some glucose. Because the Syrupus Ferri Iodidi is so lia change, a patient should not buy more than 3 or 4 fl. oz. time. The iodide may be given as a pill in the same wa recommended for Hydrargyri Iodidum Viride (see p. 2 When the syrup has turned yellow, it may be made col by exposing it to direct sunlight, for then the iodine be hydriodic acid.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

The two following (viz. the perchloride and the sulphate) *are ferric salts*; they are compounds of the h oxide of iron, Fe_2O_3.

8. Liquor Ferri Perchloridi Fortis. St solution of Ferric Chloride.

Source. Boil iron in hydrochloric acid and w Nitric acid is then added, and thus the ferrous is conve into ferric chloride. *Strength.* 20 per cent. of iron.

Characters.—An orange-brown liquid, usually cont ing some free hydrochloric acid.

Impurities. Ferrous salts.

Preparations.

1. Liquor Ferri Perchloridi.—The st solution, 25; water, to 100.

Dose, 5 to 15 m.—3 to 10 decimils.

2. Tinctura Ferri Perchloridi.—The strong solution, 25; alcohol (90 per cent.), 25; water, to produce 100. It will be noticed that the Liquor and the Tincture are the same strength. When exposed to light they become paler [illegible] the iron is reduced to the ferrous state. Glycerin, which is frequently prescribed with perchloride of iron to cover its [illegible] but the change does not appear to influence the therapeutic efficacy of perchloride of iron.

Dose, 5 to 15 m.—3 to 10 decimils.

9. Liquor Ferri Persulphatis.—Solution of Ferric Sulphate. $Fe_2 3SO_4$.

SOURCE.—A hot solution of ferrous sulphate in sulphuric acid and water is boiled with nitric acid and water.

CHARACTERS.—A dark red very astringent solution, miscible with water.

The following are scale preparations of iron, so called as they are dried to form scales. They are not well defined chemical compounds. The base of all is ferric hydrate. They are three—the tartarated iron, the ammonio-citrate, and citrate of iron and quinine.

10. Ferri et Potassii Tartras.—Tartarated Iron. (Ferrum Tartaratum B.P. 1898.)

CHARACTERS.—Garnet-coloured scales, slightly sweetish and astringent. *Solubility.*—1 in 4 of water; feebly in spirit.

IMPURITIES.—Ammonia and ferrous salts.

Dose, 5 to 10 gr.—3 to 6 decigrms.

11. Ferri et Ammonii Citras.—Iron and Ammonium Citrate.

CHARACTERS.—Red scales like the tartarated iron, but not so deep in colour. *Solubility.*—10 in 5 of water; almost insoluble in spirit.

IMPURITIES.—Tartrates and alkaline salts.

Dose, 5 to 10 gr.—3 to 6 decigrms.

Preparation.

Vinum Ferri Citratis.—Iron and ammonium citrate, 18 gr.; orange wine, 1000.

Dose, 1 to 4 fl. dr.—4 to 6 mils.

12. Ferri et Quininæ Citras.—Iron and Quin Citrate.

Characters.—Greenish-yellow scales of a bitter tast *Solubility.*—2 in 1 of water.

Impurities.—Alkaline salts and other alkaloids instea quinine.

Dose, 5 to 10 gr. 3 to 6 decigrms.

Incompatibles of Iron Salts in General.—All [illegible]ures containing tannic or gallic acid form an intense bl with per-salts of iron. Preparations of iron are therefore incompatible with all vegetable astringent solutions, and t [illegible] with which they can be prescribed are infu of quassia and infusion of calumba. It is a common mista to forget that because of its tannin, the tincture as well as t infusion of digitalis makes an inky mixture with iron prepar tions. Such a mixture may be clarified with a little di phosphoric acid, but after a few days a slight precipitat phosphate of iron falls. Per-salts of iron render mucilag [illegible]

Alkalies and their carbonates, lime water carbonat calcium, magnesia and its carbonate give green precipitat with ferrous, and brown with ferric salts. The scale prepar tions of iron, however, are not precipitated by alkaline solut

Action of Iron and its Salts.

External.—Solutions of iron salts are antisept They have no action on the unbroken skin, but wh applied locally to the abraded skin, sores, ulcers, a mucous membranes, either in solution or when d solved by the secretions, the **ferric salts** are power **astringents,** because they **coagulate albumino fluids,** both those discharged from the surface a also those in the tissue itself. There is no dire effect on the walls of the vessels, but the contract of the coagulated albumen compresses them a diminishes their calibre. Partly for this reason, still more because these salts of iron quickly ca the coagulation of blood, and the clot thus form plugs the bleeding vessels, they are among t best **local hæmostatics** we possess, and will oft very severe hæmorrhage. The perchloride and the sulphate are very strongly astringent; but the scale preparations, steel wine, reduced iron, carbonate and the phosphate of iron are so feebly astringent that they are never used local applications; in fact, to most persons they non-astringent. Oxides of iron have the property of converting oxygen into ozone, and are therefore disinfectant.

Internal. *Mouth.*—Preparations of iron have a taste, the **teeth** and **tongue** may be **blackened** they are taken, owing to the formation of the sulphide of iron, the sulphur being derived from the and the tartar on the teeth; hence it is advisable to take iron preparations through a glass tube quill. The astringent preparations have, when applied, the same action on the mucous membrane of the mouth as on the raw skin.

Stomach.—Whatever form of iron is given by mouth, it is converted in the stomach into ferric **chloride**, with probably a little ferrous **chloride**. Experience has shown that ferric chloride is physician a most valuable preparation of probably this is because it will not abstract hydrochloric acid from the gastric juice as is the case other preparations of iron. It is often stated albuminate of iron is formed in the stomach; incorrect unless more iron is given than can with the hydrochloric acid, and when albuminate is given by the mouth it will be converted chloride in the stomach. Although whatever iron is administered ferric chloride is formed stomach, the choice of the preparation is a of great importance; for if strongly acid salts the acid set free after the formation of the will act as an irritant, and damage the mucous membrane; even the preparations of the perchloride this, for they often contain a considerable

amount of free acid. These facts explain why m
preparations, especially the acid ones, so often ca
headache, nausea, loss of appetite, and other sy
ptoms of severe indigestion. We also learn why
perience has taught that the sulphate, which
often used, should be given in the form of a pill,
this, especially if coated, is not dissolved till
intestine is reached, and the acid is harmless in t
alkaline solutions of that part of the alimenta
canal. Further, we see why the preparations wh
are either not acid at all or only very slightly ac
such as the reduced iron, dialysed iron (B. P. 18
the carbonate, and the scale preparations, do n
as a rule cause indigestion. The perchloride
iron is very astringent, hence the astringent ef
on the stomach of iron salts. The non-astring
preparations can only be astringent in proportion
the amount of ferric chloride formed from them by
gastric juice; but if large quantities of astrin
preparations are given, the excess which is no
composed by the gastric juice will add its ast
gency to that of the perchloride formed in the stom

Intestines.—On passing into the intestine,
contents of which are alkaline from carbonat
sodium, the ferric chloride becomes an oxide of ir
which remains in solution owing to the presen
organic substances; the subchloride is conv
into ferrous carbonate, which is also soluble. L
down in the intestine, by the action of the sul
compounds, the nascent hydrogen, and other re
oxidized products of decomposition there pre
these compounds of iron are converted int
ferrous sulphide and tannate (the tannic acid b
derived from the vegetables in the food), and as
are eliminated with the faeces, which are turned
Large amounts of the astringent preparations h
a **constipating effect**: this is owing to there b
an excess of them, so that they are not acted u

[illegible] stomach or intestines, for the oxides and [illegible]tes are non-astringent preparations.

Absorption.—Iron is certainly taken up from the alimentary canal, for the growing child gets from its [illegible] the iron necessary for its increase in weight, [illegible] the total amount of iron in the adult body is about 38 grains (2½ grms.), it is probably [illegible] very slowly in very minute amounts, and [illegible] in food exists as organic compounds, there [illegible] doubt about the absorption of organic iron. [illegible], however, inorganic iron salts can be [illegible] has been much discussed.

[illegible] prevailing opinion, founded chiefly on histo[illegible]ence, now is that they can be taken up [illegible] intestinal epithelium and passed into the [illegible] of the blood in minute particles. This [illegible] deposited in the spleen, but later on is [illegible] to the liver, where it is built up into com[illegible] one of which is called ferratin—which [illegible] precursors of hæmoglobin; where in the body [illegible] finally made is not known, but the red marrow [illegible] to make red blood-corpuscles. Any excess [illegible] the liver, after resting there some time, is [illegible] away by the blood and excreted into the [illegible].

[illegible] opinion formerly held was that inorganic [illegible] are not absorbed. The chief reason for [illegible] was that the giving of such salts by the [illegible] not lead to more iron in the urine; but [illegible] now that this is because in such a case [illegible] of iron taken up is excreted into the [illegible] an organic compound, and as it has [illegible] that under all circumstances the bile [illegible] the merest traces of iron this excretion [illegible] by the [illegible] in the mucous membrane. [illegible] excretion of iron has been shown to take [illegible] large intestine only, whilst its absorption [illegible] in the upper part of the small intestine.

Blood. It is often stated that giving iron ca
in healthy subjects, an increased number of
blood-corpuscles, but this is very doubtful. Prob
in health it has little or no effect on the blood.

Iron salts injected into animals subcutaneous
directly into the veins cause gastro-intestinal ir
tion and paralysis from depression of the cer
nervous system. Part of the iron is stored up,
much is excreted by the gastro-intestinal mu
membrane. The amount in the urine is ha
increased. Iron given during hæmorrhage m
tains the hæmoglobin at the same point as befor
hæmorrhage.

In certain forms of anæmia (a condition
which either the amount of hæmoglobin
the number of corpuscles are diminished, or
appear to be owing to an excess of the pl
especially chlorosis, the administration of
rapidly improves the blood in all respects.
is therefore said to be **hæmatinic**; and as
improvement in the quality of the blood l
to an improvement in the functions of all
organs of the body, iron is also called a t
Tonics are drugs which indirectly improve the ac
of the several organs of the body; usually they
by improving the quality of the blood or by ai
digestion, and thus rendering the digestion and
sorption of food more easy (see p. 122). If, as alre
stated, inorganic iron is directly taken up by
intestinal epithelium and passed to the leucocytes,
benefit in anæmia is easy to understand. But we h
seen that formerly it was believed that inorganic i
is not absorbed, and if this be so, it is at first s
difficult to understand how it can benefit anæm
As the organic iron in food must be absorbed
must conclude that it is in some way or other p
tected from decomposition in the alimentary cana
we believe that the inorganic compounds which wo

if it was decomposed are incapable of absorp- Bunge's hypothesis was that in some forms of mia, especially chlorosis, organic salts of iron taken the food are in some way split up in the intestine so incapable of absorption. In those anæmic itions which can be benefited by iron the admini- on of the inorganic salts prevents the decompo- of the organic salts in the food by fixing the ssive amount of decomposing agents, which ding to Bunge are chiefly alkaline sulphides, and ing sulphide of iron. This, he says, is supported the fact that to cure chlorosis rapidly enormous of iron are often found necessary; for example, a ent will take 5 grains (·33 grm.) of reduced iron times a day, or 15 grains (1 grm.) a day. w, the whole amount of iron in the blood of ordinary healthy woman is about 38 grains 5 grms.), for there is only one atom of iron a molecule of hæmoglobin, which contains siderably over 2000 atoms. Supposing she had half her hæmoglobin, if the iron given were pletely absorbed, one day's treatment might almost her to health, but it is well known that are often required. But if this view were rect we should expect that bismuth, manganese, or , by fixing the decomposing agents, would cure sis as efficiently as iron. It has been stated that will, but Stockman has published results which in a contrary direction, and he has shown that of iron will cure chlorosis although on hypothesis it should not, for it will not fix mposing agents if they are alkaline sulphides; re is in chlorosis no excess of these sulphides intestine. Further, many think that it is not ary to give large doses of iron to cure chlorosis. jected subcutaneously cures chlorosis, but this tell in one direction more than another, for e excreted into the intestine and there fix

the alkaline sulphides. Thus the evidence is str
opposed to Bunge's view.

Remote effects.—As iron in anæmic subject
creases the amount of hæmoglobin, more oxyg
carried to the tissues, and thus the whole body
in the benefit of a course of iron, which has
been thought to have a direct effect on the kidn
a mild diuretic, and a direct effect in promotin
menstrual flow. These actions are, however,
and may be due to the general improvement in h
Iron salts have been given to produce abortion
without any result. Remote astringent effects
been attributed to them, but there is no satisfa
proof that they have any; and indeed, whe
remember that very little if any iron is absorb
an astringent form, and it cannot exist in the
in such a form, we should hardly expect that
of iron could be remotely hæmostatic or astrin
Iron is chiefly stored in the spleen, lymphatic gl
liver, and marrow; possibly it is by stimulatin
activity of this that iron cures chlorosis.

Excretion.—One milligramme of iron is el
nated daily in the urine, and this remains con
under all circumstances. Any excess of elimin
following subcutaneous injection, or excessive
sorption from the intestine, takes place through
intestinal mucous membrane.

THERAPEUTICS OF IRON AND ITS SALTS.

External. Solutions of the sulphate, th
chloride, and the Liquor Ferri Subsulph
$Fe_4O(SO_4)_5$, strength 43 p.c., official in
United States (Monsel's solution), are
valuable local astringents. It matters very
which of these is used. In England one of
solutions of the perchloride is perhaps ofte
employed. Either is of service in many cases—

xample, to stop hæmorrhage from leech-bites, from ose, from piles, or from the uterus, as in the orrhage of malignant disease. A convenient apply them is on lint or cotton wool soaked in lution, and a cavity such as the nose or uterus be plugged with the lint. The aqueous solution perchloride has been used as a spray for hæmo but as it may excite coughing it is not to be mended. It is very useful as an astringent painting on the fauces, pharynx, or tonsils in mation of these parts. It may for this pur be diluted with an equal quantity of water. olution of 1 part of perchloride of iron in 4 lycerin may be used. It has been advised to erysipelatous skin with the tincture of per de of iron. A solution of the sulphate (1 gr. fl. oz., 6 centigrms to 30 mils) has been used in

Internal.—*Gastro-intestinal tract.* The astrin preparations may be swallowed in cases of bleeding from the stomach, such as that of nant disease, ulcer, or cirrhosis. If the bleed profuse, a drachm of the Liquor Ferri Per n with a drachm of glycerin to facilitate ing may be given every hour or oftener, and sometimes apparently save a patient's life. serious hæmorrhage smaller quantities will Intestinal hæmorrhage may also be treated ame way.

tendency of the per-salts of iron to con is usually overcome by the addition of some tive; thus magnesium sulphate is commonly with the perchloride, and aloes is often pre with iron sulphate in a pill. The per-salts n given for diarrhœa, but there are many more suitable for this symptom. Chronic tion is often very effectually treated by a iron sulphate and extract of nux vomica,

but probably the efficient purgative in it i
nux vomica, although some claim that large
of iron sulphate will overcome chronic constip
Anyhow the constipating effect of the ferric s
often much exaggerated.

A rectal injection of a fluid drachm o
tincture of the perchloride of iron to half a p
water kills threadworms.

Arsenical poisoning is best treated by the h
peroxide of iron, which should be freshly prepar
mixing together 3 fl. oz. (90 mils) of Liquor
Perchloridi with 1 oz. (32 grms.) of sodium carb
diluted with water. Half an ounce should be
every five or ten minutes. An insoluble arsen
formed, and may be got rid of by a thoro
purgative dose of magnesium sulphate or some
simple purge. A dose of common salt or so
bicarbonate, followed by 1 fl. oz. (30 mils) o
Liquor Ferri Dialysatus of the B.P. 1885 d
with water, is also efficient in poisoning by arsen

Blood.—The great use of iron salts is to r
the blood to its normal condition in ana
especially chlorosis. They are useless in
nicious anæmia and generally of little valu
any, in the anæmia of leucocythæmia, exophtha
goitre, or Hodgkin's disease. All other common f
of anæmia are secondary to some definite cause,
as hæmorrhage, lead poisoning, scurvy, &c., and
treated by the removal, if possible, of the cau
the anæmia, but recovery may be aided by
administration of iron. The perchloride and
sulphate of iron are two of the most efficacious
parations, and pills containing a grain of the
sulphate, with aloes or nux vomica if constipati
present, or the Pilula Ferri, are very valuable.
usual to begin with one pill containing one gra
the dried sulphate of iron thrice a day, but gradu
the number of pills may be increased till thre

[illegible] are taken at a dose. This method of large doses of the sulphate often appears to cure more rapidly than smaller doses. If these astringent preparations cause indigestion, any of the milder preparations may be substituted. The carbonate may be given in pills in rapidly increasing doses, or the dose of reduced iron, conveniently given on bread and butter, may be pushed. Mistura Ferri Composita is a disagreeable preparation to take and to look at. The styptic taste of some of the preparations, especially the astringent ones, may be concealed by giving them with a drachm of glycerin, which acts by its viscosity and by reducing some of the ferric to a ferrous salt. It is often added to the tincture of the perchloride. The scale preparations hardly ever disagree, they are therefore used for patients with delicate digestion, and for such it is much better to make no attempt to rapidly increase the dose, but to depend on small doses spread over a long period. Liquor Ferri Albuminatis (dose, 1 to 4 fl. dr., 4 to 16 mils), Liquor Ferri Peptonatis (dose, 1 to 4 fl. dr., 4 to 16 mils), and dialysed iron (dose, 10 to 30 ♏, 6 to 18 decimils), all in the B. P. C., are very useful non-official preparations for anæmic persons whose digestion is weak. The last should be given as pills or with glycerin. Mineral waters containing iron (such as those of La Bourboule and Levico) may be given in such cases (*see* p. 231). Flitwick water contains a good deal. Often iron and quinine citrate is prescribed as a pill: powdered tragacanth and syrup is the best excipient. Treatment of anæmia by iron leads, of course, to the improvement of the numerous symptoms, such as amenorrhœa, constipation, dyspepsia, &c., which are dependent upon the anæmia. The form of neuralgia which is associated with anæmia usually yields to iron.

Syrupus Ferri Phosphatis cum Quinina et Strychnina (*see* p. 193), or Easton's syrup, is a very

popular preparation ; it is used for **anæmia**, an
promote the health and appetite during convalesc
after long illnesses. A pill very similar to
syrup, and containing iron phosphate, 1 gr. (6 c
grms.) ; quinine, 1 gr. (6 centigrms.) ; strychn
$\frac{1}{30}$ gr. (2 milligrms.) ; concentrated phosphoric a
1½ ♏ (9 centimils.) ; liquorice powder to 5 gr
decigrms.), is prepared. It is called Easton's
or Pilulæ Trium Phosphatum. A similar table
in the market.

The iodide of iron has been given, someti
apparently with success, in cases of **rheuma**
arthritis, but it must be continued thrice daily
many months. A pill is often preferable to
syrup, as that so readily changes. Two grains
be made into a pill in the same way as that advi
for the green iodide of mercury (*see* p. 213), and
or two such pills may be given thrice a day.

Large doses of iron (10 or even 20 minims
the tincture of the perchloride every hour or t
have been given in **diphtheria** and other for
of bad sore throat, such as hospital sore-thr
apparently with considerable benefit. **Erysipe**
has been treated in the same way. Fever
to other causes is said to contra-indicate the
of iron.

Kidneys.—Iron salts are reported to have a fee
diuretic action, but this is doubtful. The perchlor
is often given empirically for all forms of Brigh
disease. Whether it does good unless anæmia
present is undecided.

As iron is liable to cause indigestion, it shou
not be given near a meal. Occasionally a patie
is found who cannot take iron in any form, becau
of the headache and indigestion caused by it.

The different preparations of iron.—These have alrea
been classified into astringent and non-astringent. There a
some, viz. the iodide, the phosphate, and the citrate of ir

and quinine, the value of which depends in part at least upon the other ingredient. The arsenate (not official) must be given in such small doses to avoid arsenical poisoning that it is [illegible] the iron in it has no effect. Hence arsenious acid might as well be given, and this is commonly done. The phosphate, which always contains some free phosphoric acid, is an excellent hæmatinic. It is used largely for children, because the syrup of it is very pleasant in taste, and also because it was formerly believed that the phosphoric acid would aid the growth of bones, especially in cases of rickets. The iron arsenate has been introduced for cases in which we wish to gain the benefit of both elements, but the proportion of iron to arsenic is small (1 to 4½). It is especially liable to damage the

The citrate of iron and quinine combines the virtues of iron and quinine. It is a favourite mild preparation for slight cases of anæmia, but must not be prescribed with alkalis, as they precipitate the quinine.

Parrish's Food.—(Not official.)

A compounded preparation, known also as Squire's Chemical Food. The Syrupus Ferri Phosphatis Compositus of the B.P.C. corresponds to it. The ingredients of this are iron wire, concentrated phosphoric acid, precipitated calcium carbonate, potassium bicarbonate, sodium phosphate, cochineal, sugar, orange flower, and distilled water.

Dose, ½ to 2 fl. dr.—2 to 8 mils.

This is a pleasant preparation, given for the sake of the phosphates and iron in it. Children take it easily.

MANGANESIUM.

Manganese. Symbol, Mn. Atomic weight, 54·93. (Not official.)

Potassii Permanganas.—Potassium Permanganate. $KMnO_4$.

SOURCE.—It may be obtained by the interaction of potassium chlorate, potassium hydroxide, and manganese dioxide.

CHARACTERS.—Dark purple, delicate, slender prisms. *Solubility.*—1 in 20 of water; a grain gives a fine purple colour to a gallon of water.

INCOMPATIBLES.—It is very readily deoxidized in the presence of organic matter. It is usually given as a pill or a tabella, and should it be made up with [illegible] or parafin, explosion will very likely take place.

Impurities.—Potassium carbonate, black manga oxide.

Dose, 1 to 3 gr. 6 to 20 centigrms., in a pill.

Preparation.

Liquor Potassii Permanganatis. *Streng* 1 per cent. solution in distilled water. It has a nasty taste, and is easily deoxidized in the presenc organic matters to a brown colour.

Dose, 2 to 4 fl. dr.—8 to 16 mils.

ACTION.

External. In the solid form Potassium Perm ganate is a mild caustic and is, when kept dry permanent salt. Its most important action is t when moist it readily gives up its oxygen in presence of organic bodies, and its solutions theref quickly turn dark brown, manganese dioxide be formed. The power possessed by its solution giving up oxygen makes it a **disinfectant, deodora** and **antiseptic**, especially as much of the oxygen is the form of ozone. But its action as a germicide very limited, for it so readily gives up its oxyg to the organic substances in which the micro-orga isms flourish that it very soon becomes inert.

Internal. Potassium permanganate when tak internally must be quickly decomposed. Ma ganese salts are only absorbed from the intesti in extremely minute quantities. When they a injected into the blood they are excreted in th urine and into the intestine. Probably they have important action after absorption. Formerly it wa thought that they could replace iron in the bod but this is not so. The red corpuscles do not tak up manganese.

THERAPEUTICS.

External.—Although potassium permanganate is not of much practical use as a germicide, it is commonly employed as a deodorant for drains, bedpans, to wash utensils, and to wash the hands; for the last purpose it is suitable as being non irritant. It has one advantage: namely, that it is easy by its change in colour to see when it has lost its efficacy. 1 in 150 is a serviceable strength. Condy's red fluid consists of 8 grains (5 decigrms.) of sodium permanganate to the fluid ounce (30 mils) of distilled water. It is expensive for purposes requiring a large quantity. It stains fabrics. The stain may be got out by applying sulphurous acid, but the fabric must be immediately rinsed in water, for sulphuric acid is formed.

Internal. The official liquor of potassium permanganate diluted to 1 in 50 can be used as a mouth wash or gargle in foul conditions of the mouth, or as an injection in cases of foul discharges, such as may occur with gonorrhœa, vaginitis, uterine disease, or ozæna. Some have considered that potassium permanganate is beneficial for the same cases of anæmia as iron, but probably it has no effect. Others praise its power in amenorrhœa. It should always be given as a pill or tabella, for the taste of solutions of it is very nasty. It oxidizes morphine and is therefore an antidote to opium poisoning.

GROUP VI.

Containing **Mercury** only.

I. HYDRARGYRUM.

Mercury. Quick-silver. Symbol, Hg. Atomic weight, 200

[illegible]

Characters.—A [illegible] fluid metal, [illegible]

Impurities.—Lead, tin, and other metals.

Preparations containing free mercury.

1. Hydrargyrum cum Cretâ. *Synonym.* Grey powder. *Strength.*—1 of mercury with 2 of pre pared chalk. By keeping, the mercury is liable t become mercuric oxide, which makes the powder mor active.

Dose, 1 to 5 gr. 6 to 30 centigrms.

2. Emplastrum Hydrargyri. Mercury, 32 olive oil, 18; sublimed sulphur, 2; lead plaster, 652 The sulphur provides the globules of mercury with fine coat of sulphide of mercury, and this prevent their running together. *Strength.*—1 in 3 of mercur approximately.

3. Linimentum Hydrargyri. Mercurial ointment, 5; strong solution of ammonia, 4; camph liniment, 8. *Strength.*—1 in 10 of mercury, nearly.

Contains [illegible] of the amount of mercury B. P. 1898.

4. Pilula Hydrargyri. *Synonym.*—Blue pil Mercury, 4; confection of roses, 6; liquorice, *Strength.* 1 in 3 of mercury.

Dose, 4 to 8 gr. 25 to 50 centigrms.

5. Unguentum Hydrargyri. *Synonym.* Blue ointment. Mercury, 30; benzoated lard, 65; prepared suet, 5. *Strength.*—1 in 3 of mercury. Approximately the strength of the corresponding preparation, B. P. 1898. After this ointment has been kept some time it contains metallic mercury, mercuric oleate, and mercurous and mercuric oxides.

In India benzoated suet should be used instead of benzoated lard.

6. Unguentum Hydrargyri Compositum. *Synonym.*—Scott's ointment. Mercurial ointment, 10; yellow wax, 6; olive oil, 6; camphor, in flowers, 3. *Strength.* 1 in 5 of mercury. Approximately ? the strength of the corresponding preparation, B. P. 1898.

2. Hydrargyri Oxidum Rubrum. Red Mer- Oxide. HgO. *Synonym.*—Red precipitate.

SOURCE.—Obtained by heating mercuric nitrate until [illegible] vapours cease to be evolved.

CHARACTERS.—An orange-red powder or crystalline scales, almost insoluble in water.

IMPURITIES.—Red lead, brickdust, nitrate of mercury.

Preparation.

Unguentum Hydrargyri Oxidi Rubri. *Synonym.*—Red precipitate ointment. Red mercuric oxide, 1; yellow paraffin ointment, 9.

3. Hydrargyri Oxidum Flavum. Yellow Mercuric Oxide. HgO.

SOURCE.—Obtained by the interaction of aqueous solutions of mercuric chloride and caustic soda.

CHARACTERS.—A yellow powder, insoluble in water. Not used internally. It is contained in Lotio Hydrargyri Flava. It has the same composition as the red oxide, but is amorphous.

Preparation.

Unguentum Hydrargyri Oxidi Flavi. Yellow mercuric oxide, 1; yellow soft paraffin, 49.

4. Hydrargyri Perchloridum. Perchloride of Mercury. Mercuric Chloride. *Synonym.* Corrosive sublimate. $HgCl_2$.

SOURCE.—Heat a mixture of mercuric sulphate, sodium chloride, and manganese dioxide. The perchloride sublimes and is condensed.

CHARACTERS.—Heavy, colourless masses of prismatic crystals. *Solubility.*—1 in 18 of water; 1 in 3 of alcohol ([illegible] per cent.). It must be dissolved in distilled water, for ordinary water decomposes it.

INCOMPATIBLES.—Alkalies and their carbonates, potassium iodide, lime water, tartar emetic, silver nitrate, lead acetate.

albumen, soap, vegetable preparations containing tannic ac
and in fact most substances.

Dose, $\frac{1}{32}$ to $\frac{1}{16}$ gr.—2 to 4 milligrms.

Preparations.

1. Liquor Hydrargyri Perchloridi. Mercu
chloride, 1; distilled water, 1000. *Strength.*—0·1 p
cent.; $\frac{1}{16}$ gr. in 110 m; 0·1 grm. in 100 millilitres.

Dose, 30 to 60 m.—2 to 4 mils.

2. Lotio Hydrargyri Flava. *Synonym.*
Yellow wash. Mercuric chloride, 4·6; lime wate
1000. *Strength.*—2 gr. in 1 fl. oz. nearly.

5. Hydrargyri Subchloridum. Subchloride o
Mercury, Mercurous Chloride. *Synonym.* Calomel. H_2C

SOURCE. Obtained as a sublimate by heating a mixtur
of mercurous sulphate and sodium chloride.

CHARACTERS. A dull white, heavy, insoluble, nearl
tasteless powder.

IMPURITY.—Mercuric chloride.

Dose, $\frac{1}{2}$ to 5 gr. 3 to 30 centigrms.

Preparations.

1. Lotio Hydrargyri Nigra. *Synonym.* Black
wash. Calomel, 6·85; glycerin, 50; lime water, t
make 1000. *Strength.*—3 gr. to 1 fl. oz. nearly.

**2. Pilula Hydrargyri Subchloridi Com
posita.** *Synonym.*—Plummer's pill. Calomel, 20;
sulphuretted antimony, 20; guaiacum resin, 40; gum
acacia, 1; tragacanth, 1; syrup of glucose, 1
Strength.—Calomel, 1 in $4\frac{1}{2}$ nearly.

Dose, 4 to 8 gr. 25 to 50 centigrms.

3. Unguentum Hydrargyri Subchloridi.—
Calomel, 1; benzoated lard, 4.

This ointment is twice the strength of the corre
sponding preparation, B. P. 1898.

In India benzoated suet should be used instead o
benzoated lard.

6. Hydrargyrum Oleatum. Mercuric Oleate
(Hydrargyri Oleas, B. P. 1898.)

SOURCE.—Triturate mercuric oxide, 20; with liquid
paraffin, 5; add oleic acid, 75; stir and heat.

CHARACTERS. A light greyish yellow, oleaginous, semi
solid substance

Preparation.

Unguentum Hydrargyri Oleati.—Mercuric eate, 1; benzoated lard, 3.

In India benzoated suet should be used instead of benzoated lard.

7. Hydrargyri Iodidum Rubrum. Red Io ide of Mercury, Mercuric Iodide, Biniodide of Mercury. HgI_2.

SOURCE. Obtained by the interaction of mercuric loride and potassium iodide.

CHARACTERS. A vermilion crystalline powder, feebly luble in water, but easily in a solution of potassium iodide.

IMPURITIES.—The same as of the perchloride.

Dose, [illegible] to [illegible] gr. – 2 to 4 milligrms.

Preparations.

1. Liquor Arsenii et Hydrargyri Iodidi. *Synonym.* Donovan's solution. Dissolve equal parts of arsenious iodide and mercuric iodide in water. A clear pale yellow liquid. *Strength.* 1 per cent. of each iodide.

Dose, 5 to 20 m. – 3 to 12 decimils.

2. Unguentum Hydrargyri Iodidi Rubri. Mercuric iodide, 1; benzoated lard, 24.

In India benzoated suet should be used instead of benzoated lard.

8. Hydrargyri Iodidum Viride. HgI. (Not ficial.) Green Iodide of Mercury. *Synonym.*—Subiodide f mercury.

SOURCE.—Rub together mercury and iodine with a few rops of spirit.

CHARACTERS.—A dull green powder insoluble in water. Must be kept in the dark, for it very soon becomes the red iodide. Keeps better if a slight excess of mercury is present.

Dose, $\frac{1}{6}$ to 2 gr. – 10 to 120 milligrms. in a pill. It best prescribed thus: Hydrargyri Iodidum Viride, the quired dose; milk sugar, [illegible] gr.; excipient, q.s. The excipient has the following composition: Tragacanth powder (not Co.), 240 gr.; water, 240 ♏; syrup of glucose, ℥ij.

9. Liquor Hydrargyri Nitratis Acidus.—Mercuric Nitrate, or Pernitrate of Mercury. $Hg(NO_3)_2$ in solu on in nitric acid.

Source.—Dissolve 120 of mercury in 150 of nitric ac with 45 of water, and heat.

Characters.—A colourless, strongly acid liquid contai ng much free nitric acid. Sp. gr. 2·0.

Impurity.—Mercurous nitrate.

10. Unguentum Hydrargyri Nitratis. Sy onym.—Citrine ointment.

Source.—Mix a solution of 1 of mercury in 3 of nit acid, with 4 of prepared lard and 7 of olive oil. In Ind benzoated suet should be used instead of benzoated lard.

Characters.—A lemon-yellow ointment.

Preparation.

Unguentum Hydrargyri Nitratis Dilutum Mercuric nitrate ointment, 1; soft yellow paraffin, 4

11. Hydrargyrum Ammoniatum. Amm niated Mercury. NH_2HgCl. *Synonyms.*—White precipitate ammonio-chloride of mercury.

Source.—Mix solutions of ammonia and perchloride of mercury. Filter and wash the precipitated ammoniated mercury.

Characters.—An opaque white powder, very insoluble.

Impurities.—The same as in the perchloride.

Preparation.

Unguentum Hydrargyri Ammoniati. *Syn onym.*—White precipitate ointment. Ammoniated mercury, 5; benzoated lard, 95.

This is approximately one-half the strength of the corresponding preparation, B. P. 1898.

In India benzoated suet should be used instead of benzoated lard.

Action of Mercury and its Salts.

External.—The **perchloride of mercury** is one of the **most powerful** and important **antiseptics** with which we are acquainted. In 1870 it was discovered that 1 part in 6000 would kill infusoria and spermatozoa. Now it is known to be a universal germicide. The published results of experiments with it vary very much, because the duration of the action, the solvent, and the micro-organism experimented upon are not always the same. Evans (Guy's Hosp. Rep., vol. xlvii.) found that anthrax spores were destroyed by corrosive sublimate solutions of 1 in 1000 acting for a quarter of an hour, and 1 in 3000 acting for one hour. The bacilli themselves were destroyed by solutions of 1 in 10,000 acting for one minute, and 1 in 25,000 acting for half an hour. A solution of 1 in 70,000 prevented the growth of the spores, and one of 1 in 500,000 prevented the growth of the bacilli. A reference to carbolic acid will show how much more powerful corrosive sublimate is. A solution of 1 in 1000 is very commonly employed for many disinfecting purposes. If albumen be present in the fluid to be disinfected, an albuminate of mercury is formed, and the antiseptic value of the fluid is destroyed. This change may be prevented by the addition of 5 parts of either hydrochloric or tartaric acid to 1 of corrosive sublimate. The biniodide, dissolved in potassium iodide solution, is also a powerful antiseptic. Metallic instruments cannot be disinfected with the perchloride, for mercury is deposited on them.

Most mercurials, especially the oleate, oxide, ammoniate, nitrate, and perchloride, will destroy the animal and vegetable parasites that infest the skin; they are therefore **antiparasitic**. Also most of them will occasionally relieve itching, even when no cause is to be found.

The soluble salts are powerful irritants, for the albuminate of mercury formed is dissolved in the fluids of the tissues, and the acid of the mercurial salt exerts its irritant action; the acid solution of the nitrate is strongly caustic. Insoluble salts are slightly irritant and stimulating; calomel is sometimes applied to sores for this property.

Metallic mercury and its salts are **absorbed by the skin**, especially when rubbed in either as an oleate or an ointment. These preparations are also taken up, although to a less degree, if simply applied to the skin, for minute particles of mercury or its salts pass into the hair follicles and sebaceous follicles, from which they are absorbed as an oxide or a chloride. All the symptoms of mercurial poisoning can be produced if the drug is absorbed through the skin. The **vapour** can be **absorbed** through the mucous membrane of the **lungs**, and mercury compounds are so volatile that when they are applied to the skin some usually enters the blood by the lungs.

Internal. Although the different salts of mercury have different external actions, after absorption their actions are, in most respects, similar. The long-continued use of excessive doses of mercurials produces well-marked and important symptoms (*see* Toxicology). The actions for which mercurials are used in medicine are the following.

Stomach and Intestines. The **metal** mercury itself and **mercurous** compounds, being **mildly irritant** in their action, are often used as **purgatives**; but the mercuric compounds given in the same doses produce severe gastro-intestinal irritation. The action is chiefly on the duodenum and upper part of the jejunum: the precise mode of irritation is unknown, but it is certain that, in consequence of the administration of the mercurial, the contents of the duodenum are hurried along before there is time for the bile to be reabsorbed or altered, and hence the motions are very dark-coloured. There is probably some, but not an excessive increased secretion from the intestinal walls, for the motions, although large and loose, are not watery. As the action of the mercurial is chiefly on the upper part of the intestine, it is greatly assisted by giving a saline purge a few hours after it, for this will act more on the lower part in the bowel. The contents are passed along so quickly, that it is doubtful whether there is time for much mercury to be absorbed if a purgative dose of it has been given. Calomel and the metallic preparations are the two forms most used as purgatives. The former is the more powerful.

Whatever compound of mercury is taken by the mouth, it, in the stomach, becomes a complex albuminate containing mercury, sodium, chlorine, and albumen. This compound, in the presence of the sodium chloride in the stomach, can exist in solution there. This same compound is formed when perchloride of mercury is injected subcutaneously, and therefore the solution for injection should contain little sodium chloride. Precisely what happens to in the duodenum is doubtful, but it is quite certain that if the dose is insufficient to cause purgation some mercury is absorbed as an albuminate, the rest passing out of the bowel as a sulphide.

Liver. It was formerly taught that calomel increased the amount of bile formed by the liver. This is now known to be an error, but perchloride of mercury may possibly slightly increase the quantity, and perhaps, occasionally when calomel is administered, some of it is converted into the perchloride. Calomel and, to a less extent, preparations of metallic mercury are, however, called **indirect cholagogues**, because they, in the manner already explained, aid the excretion of bile, and being powerful antiseptics increase its purgative action by preventing its decomposition, hence the stools are dark green; they contain calomel, mercuric sulphide, and unaltered bile.

Blood. After absorption the mercurial compound formed in the stomach and intestines probably becomes oxidized, and circulates as an oxyalbuminate. Minute long-continued doses of mercury slightly increase the richness of the blood in red corpuscles, and may add a little to the weight of the body. **Large doses** produce **anæmia**. Mercur checks the emigration of white corpuscles, and thi perhaps explains its antiphlogistic action.

Remote effects.—Mercury is mainly excreted b the cæcum, colon, and saliva; in large doses it irri tates the salivary glands, and is a powerful **sialogogue** Minute amounts are excreted by the urine, swea milk, and bile. By itself it is in health a feebl diuretic, but it sometimes powerfully aids othe diuretics when dropsy is present. It is eliminate very slowly, and hence accumulates in the body especially in the liver, kidneys, and spleen.

Therapeutics of Mercury and its Salts.

External.—*Antiseptic action.* Solutions of th perchloride are very largely employed. A strength o 1 in 1000 is used for washing the hands, for washin the parts to be operated upon, for soaking towel lint, sponges, &c., used in operations, for washin infected articles, infected rooms, furniture, linen, &c For wounds and cavities (as the uterus), the strength for a single washing should not exceed 1 in 2000 for continual irrigation 1 in 10,000. Corrosiv sublimate discs, tinted blue, made so that one dissolved in a pint of water makes a solution of 1 in 500, are a convenient form in which to carry the antiseptic. Corrosive sublimate solutions shoul always be tinted blue to render them easy to recognize.

Antiparasitic action. White precipitate ointment, dilute nitrate of mercury ointment, and a wash of the perchloride are very useful for destroying lice on the head; and these three, especially the last, are excellent for destroying the fungus in ringworm and favus. The mercuric oleate is useful for destroying that in pityriasis versicolor; if the skin is easily irritated the ointment of it should be used. Mercurials ld not be applied over so large an area that there a risk of poisoning from absorption.

Irritant action.—The acid solution of the nitrate used to destroy warts, condylomata, &c.; no doubt h of its caustic action is due to the free nitric d it contains. Milder preparations, such as the ute ointment of the nitrate, or the red oxide ointment if diluted, may be used for tinea tarsi; and the se ointments are very beneficial to any ulcer or that requires a stimulant, whether or not it be philitic. When a milder preparation is required mel is often dusted on the part, and black wash very commonly used, especially for syphilitic sores d condylomata.

Itching.—Black wash, yellow wash, or Unguen- Hydrargyri may be employed to relieve the ing of skin diseases, such as prurigo senilis and eczema, if they are not too extensive. A very ourite ointment for many skin diseases is comed of equal parts of the dilute mercuric nitrate, oxide, and lead acetate ointments (*see* p. 181).

Absorbent action.—All mercurial ointments and oleate, when applied to or gently rubbed into any which is chronically inflamed, often aid the ption of the products of inflammation, if they not too deep seated. For this purpose blue oint and Scott's ointment, or the oleate ointment, very commonly used for chronic inflammation ents, chronically enlarged glands, and chronic tonitis, which certainly sometimes appears to be d by the application of a binder spread with one these preparations or the Linimentum Hydrargyri, when the disease is tuberculous. Sixty grains rms.) of blue ointment rubbed into the skin daily, ng a different situation each day in the week, is usual and very efficacious manner of treating philis. The ointment of the red iodide is in India plied to the thyroid gland in goitre.

Internal.—*Astringent.* Very dilute solutions of the perchloride (4 gr., 25 centigrms., to 10 fl. oz., 300 mils. water with 1 fl. dr., 4 mils. of dilute hydrochloric acid and a little glycerine may be used as a mouth wash for syphilitic ulceration. Ringer advises grey powder in minute doses for the sudden vomiting immediately after food sometimes met with in children. By far the most important intestinal action of mercury is its purgative effect. Calomel and blue pill are pre-eminently the purgatives to employ when there is, from the headache, constipation, furred tongue, feeling of weight over the liver, and general lassitude, reason to suspect that the dyspepsia is hepatic. Either of these drugs at night, followed by a watery purge, as Mistura Sennæ Composita, in the morning, will often completely relieve the symptoms. The blue pill at night and black draught (Mistura Sennæ Composita) in the morning have long been a favourite combination. Mercury or calomel is also one of the best purgatives for cases of cirrhosis, and for cardiac cases in which there is considerable hepatic congestion. Grey powder mixed with a little sugar is an excellent purgative for children, or even for adults, when a very mild purge is required—as, for example, after severe enteritis or peritonitis, or if it is desirable to open the bowels during typhoid fever. Children take mercury very well. Infants can easily bear grain doses of the grey powder. As diarrhœa, especially in children, is so often due to the presence of some irritant, a simple purgative, as grey powder, will, by removing it, often cure the diarrhœa. This preparation hardly ever causes griping, but calomel is liable to do so. Mercury compounds, on account of their intestinal antiseptic action, have been given in Germany for typhoid fever (see pp. 86 and 100).

Remote uses.—In cases of heart disease mercury often combined with digitalis and squill as a diuretic (as in the well known Guy's diuretic pill: mercury pill 12 gr., 8 decigrms., powdered squill root 12 gr., 8 decigrms., powdered digitalis leaves 12 gr., 8 decigrms., extract of hyoscyamus 20 gr., 12 decigrms.; make 12 pills), and in some cases this combination does great good.

Syphilis.—Mercury in any form is powerfully antisyphilitic. The perchloride is often used for adults, and grey powder for children. This action is so important that it makes mercury one of the most valuable drugs we have. It has been mentioned that it may be applied locally to syphilitic ulcerations, but to be of use it is essential that it should also be administered so as to reach the blood. It is a direct poison to the spirochæta pallida, the cause of syphilis; it can completely cure the patient; its use must be long continued, but should never be pushed to salivation. Treatment should be begun as early as possible. It is especially valuable in the primary and secondary stages; also it is of great value in tertiary syphilis. It is as efficacious for the congenital as for the acquired disease. It is also administered for non-syphilitic varieties of chronic inflammation, but not so often as formerly. Patients with disease of the kidneys do not bear it well.

The green iodide was commonly prescribed for syphilis, and often succeeds when other preparations have failed. Its great disadvantage is its instability. Mercurous tannate (dose, 1 to 2 gr., 6 to 12 centigrms., in a pill) is strongly recommended by some authorities.

Sal Alembroth.—(Not official.)

Ammonio-mercuric Chloride, a double chloride of mercury and ammonium.

SOURCE.—Mix 271 parts of corrosive sublimate with 107 of ammonium chloride, both in solution, and evaporate.

CHARACTERS.—[illegible] free [illegible]

ACTION AND THERAPEUTICS.

Sal alembroth gauze (containing 1 per cent.) and sal alembroth wool (2 per cent.), both tinted with aniline blue, which is bleached by the discharge, so that it is easy to see if it has soaked through, are much used to dress wounds antiseptically.

Sal alembroth injections ($\frac{1}{3}$ gr., 23 milligrms., in 10 ♏, 6 decimils, of water) are a convenient non irritating form in which to inject mercury intramuscularly in syphilis.

Mercuro-zinc Cyanide. (Not official.)

Consists of one molecule of mercuric cyanide combine with four molecules of zinc cyanide.

CHARACTERS. A white powder.

ACTION AND THERAPEUTICS.

Mercuro-zinc cyanide gauze and wool, each containing 3 per cent. of the salt, and tinted mauve pink with rosolane, are used in antiseptic surgery as the salt is unirritating. It is also used as an ointment.

Modes of administration of mercurials.—(1) **By the mouth.**—The Liquor Hydrargyri Perchloridi is often given adults, usually in doses of 1 to 2 fl. dr. (4 to 8 mils). For the later symptoms of syphilis, potassium iodide is often combine with it. Periodide of mercury is formed and is kept solution by the excess of potassium iodide. Mercurous iodide, or the green iodide of mercury (p. 213), is much used by some. It is insoluble in water and is incompatible wit potassium iodide, the red iodide and metallic mercury being formed. The best preparation for children is $\frac{1}{2}$ to 1 gr. (3 to 6 centigrms.) of grey powder, given just often enough to avoid [illegible] and 1 to 2 gr. (6 to 12 centigrms.) three times a day [illegible] given to adults.

(2) **By the rectum.** Occasionally mercury is given as a suppository.

(3) **Endermically.** [illegible] are [illegible] Mercury [illegible] this way.

(4) **By inunction.** [illegible] rubbed into [illegible] The part of the body [illegible] should be [illegible] A very [illegible] way of applying [illegible] on a [illegible] The [illegible] employed for [illegible] of the [illegible] mercury, [illegible] many [illegible] left [illegible] resumed.

(5) **Intramuscularly.** One [illegible] of a grain [illegible] of the [illegible] dissolved [illegible] 5 [illegible] of distilled water with a trace of [illegible] may be used [illegible] The needle of a hypodermic [illegible] deeply into the [illegible] muscles, preferably those [illegible] It [illegible] of ice may be [illegible] part before the injection [illegible] after the needle is withdrawn. The injection should be [illegible] daily. Before going to bed is a good time. With [illegible] care no abscesses [illegible] It is a very rapid and [illegible] way of bringing the patient under the influence [illegible] mercury. Mercuric [illegible] and mercuric [illegible] to [illegible]

Mercury is, however, [illegible] given intramuscularly [illegible] for [illegible] only once weekly [illegible] 2 oz. [illegible] carbolized [illegible] paraffin, ad 5 oz. (160 grms.). This equals gr. 1 in [illegible] centigrms. in 60 centim.). Maximum dose [illegible]

0 centimils) once a week. There are many other form
or oils and creams of mercury for intramuscular injec
e.g. Oleum Cinereum (Grey Oil) B. P. C. If calomel is used
dose is ½ gr. (3 centigrm.). However mercury or its salts
given, administration for two years is necessary to effic
treat syphilis. The inunction and intramuscular methods
the best. The teeth and mouth must be kept clean to a
salivation, and there should be short intervals when merc
is not given.

(6) **Fumigation.** Calomel is used. The patient, wh
naked, sits on a cane-bottom chair; a blanket, which reac
to the floor, is fastened lightly round his neck. Twenty gra
of calomel are placed in a porcelain dish over a spirit la
under the chair. The calomel volatilizes, and is absorbed
the skin. A bath should last twenty minutes; with obvi
modifications this method may be applied to patients in be

(7) **Inhalation.**—This is rarely or never used.

(8) **Baths** of 180 grains of the perchloride to th
gallons of water, with one fluid drachm of hydrochloric a
added, have been used, but they are very rarely employed.

TOXICOLOGY.

Acute poisoning is rare. Salts of mercury, especi
the per-salts, produce severe gastro-intestinal irritation, caus
great pain, vomiting, and diarrhœa. Corrosive sublimate a
white precipitate are the preparations usually taken. Ac
poisoning has followed washing out large cavities with so
tions of perchloride of mercury.

Chronic poisoning by mercury or its salts produce
train of remarkable symptoms. They were very common wh
it was the practice to give larger doses of mercurials than
now employed, and they are occasionally seen in those w
work in mercury. In the present day, when the patient sho
any sign of mercurialism, the dose is reduced. These sy
ptoms (which constitute hydrargyrism or mercurialism) may
brought about however the mercury is taken. The first indi
tions noticed are slight fœtor of the breath and soreness of t
gums when the teeth are knocked. Then follows a disagreea
metallic taste in the mouth, the gums become swollen and so
and they bleed readily. Next there is a considerable increa
in the amount of saliva secreted. All these sympto
gradually become more marked, and the tongue swells. T
teeth are now loose, the saliva, which is thick and visc
pours over the mouth, the parotid and salivary glands a
enlarged and tender, and there is a slight rise of temperatu

In olden days these symptoms occasionally ended in the falling out of the teeth, extensive ulceration of the mouth and tongue, necrosis of the jaw, great weakness, emaciation, anæmia, a watery state of the blood, a liability to hæmorrhages, exhaustion, and death.

More rarely the symptoms are, for the most part, nervous. They occur chiefly, if not entirely, among those who work in the metal and inhale the vapour. The first to be observed is tremor beginning in the face, then invading the arms, and afterwards the legs. Early in the case the trembling is seen only on movement; soon it is permanent. It resembles paralysis agitans. Usually there is considerable weakness of the affected muscles ("mercurial palsy"). There may be pains, and a weak mental condition is common. Nothing has been found post mortem, to account for these symptoms.

GROUP VII.

Arsenic, Antimony, Chromium.

The compounds of these metals have several physiological and some chemical points in common. The oxide of each is externally a powerful caustic. Internally, arsenic, antimony and (as far as we know) chromium compounds are severe gastro-intestinal irritants. Arsenic and antimony in large doses both cause general fatty degeneration.

ARSENIUM.

Metallic Arsenic. Symbol, As. Atomic weight, 74·96.
(Not official.)

1. Acidum Arseniosum. Arsenious Anhydride containing not less than 99·8 per cent. of arsenious oxide, As_2O_3. *Synonyms.* Arsenic; Arsenious Acid; White arsenic.
SOURCE.—Arsenical ores are roasted and purified by sublimation.

CHARACTERS.—A heavy white powder, or stratified opaque white masses. The strata are caused by the presence, in alternate layers, of the crystalline and opaque, and of the amorphous and vitreous allotropic modifications of arsenious anhydride. *Solubility.*—1 in 100 of cold, 1 in 10 of boiling water. When volatilized and sublimed, it forms minute, transparent, brilliant octahedral crystals. When heated cha[illegible] it gives off a garlic-like odour.

Incompatibles. Lime water, salts of iron, magnesia

Impurities.—Lime salts.

Dose, $\frac{1}{64}$ to $\frac{1}{16}$ gr.—1 to 4 milligrms.

Preparations.

1. Liquor Arsenicalis. *Synonym.*—Fow solution. Arsenious acid, 10; potassium carbo 10, boil in 500 of water, and add compound tin of lavender, 30; water, 500. No decomposition oc but an alkaline solution of arsenious acid is for *Strength.* 1 gr. of arsenious acid in 110 ♏, 1 gr 100 millilitres, or 1 per cent.

Dose, 2 to 8 m.—12 to 50 centimils.

2. Liquor Arsenici Hydrochloricus.— senious acid, 10, is boiled with hydrochloric acid, 12, water, 1000. No decomposition occurs, but an solution of arsenious acid is formed. *Strength.* of arsenious acid in 110 ♏, 1 grm. in 100 millilitr 1 per cent.

Dose, 2 to 8 m.—12 to 50 centimils.

2. Sodii Arsenas Anhydrosus. — Sod Arsenate, Disodium Hydrogen Arsenate. Na_2HAsO_4 (Arsen of Sodium, B. P. 1885; Sodii Arsenas, B. P. 1898).

Source. Expose to a temperature of 150° crystall sodium arsenate, which may be prepared by treating w water the product of the fusion of arsenious anhydride w sodium nitrate and sodium carbonate.

Characters.—A white powder. The hydrous form, wh contains seven molecules of water of crystallization, is of seen, and was official in B. P. 1885.

Solubility.—1 in 6 of water. The solution is alkalin

Dose, $\frac{1}{40}$ to $\frac{1}{10}$ gr. 1·5 to 6 milligrms.

Preparation.

Liquor Sodii Arsenatis. *Strength.*—1 cent. of anhydrous sodium arsenate in distilled wa It contains about half as much metallic arse as Liquor Arsenicalis.

Dose, 2 to 8 m.—12 to 50 centimils.

3. Arsenii Iodidum.—Arsenious Iodide. AsI$_3$.

SOURCE. Made by the direct union of iodine and metallic arsenic.

CHARACTERS. Small orange coloured crystals or crystalline masses. Soluble in water and in alcohol. Solution neutral.

Dose, $\frac{1}{20}$ to $\frac{1}{5}$ gr. 3 to 12 milligrms.

Preparation.

Liquor Arsenii et Hydrargyri Iodidi. *Synonym.*—Donovan's solution. *See* Mercury, p. 213.

ACTION OF ARSENICAL COMPOUNDS.

External.—Arsenious acid has no action on the skin, but applied to raw surfaces it is a powerful caustic.

Internal.—*Alimentary canal.*—Unless the dose is very small, all preparations containing arsenic are very severe **gastro-intestinal irritants** (*see* Toxicology). Part at least of this effect is due to excretion of the arsenic into the stomach after absorption, for if given subcutaneously there may be no local effect, although there is intense gastritis soon after injection. In minute doses they are gastric stimulants, causing dilatation of the gastric vessels and an increased flow of gastric juice. Small doses also stimulate the duodenum.

Blood. Arsenic is quickly absorbed into the blood, and is found especially in the polymorphonuclear white corpuscles. It cannot in health, but can in some forms of anæmia increase the hæmoglobin and the number of red corpuscles; how it does this is unknown. Arsenic given during hæmorrhage has little effect on the blood, but if combined with iron it maintains the hæmoglobin even more than iron alone. It may cause brown pigmentation of the skin, and then the depth of pigmentation appears to be proportionate to the increase in the red corpuscles.

Bone.— In animals arsenic slightly stimulate
formation of compact bone. In small repeated
it increases the leucoblasts but not the erythrob
of marrow, it dilates the vessels and leads to atr
of the fat. In doses large enough to cause ge
emaciation the marrow undergoes hyaline dege
tion. All these changes occur with many other
and are not peculiar to arsenic

Circulation.—In the frog the rapidity and
of the heart are lessened till it finally stops.
is a local action, for it takes place when applie
the excised heart. Large doses destroy the capill
and lead to hæmorrhage.

Remote effects. In many diseases arsenic
dently profoundly affects metabolism, for the pa
recovers under treatment by this drug. If give
small doses to healthy persons it usually impr
the general condition, probably by increasing m
bolism, but perhaps only by sharpening the appe
It has been incorrectly stated to unite with album
another view, that of Binz and Schulz, is
arsenious acid becomes arsenic acid by taking oxy
from the protoplasm, but that the arsenic acid
sequently yields up the oxygen again and that
activity of arsenic is due to its being a carri
oxygen. It makes the skin glossy. Some of the pe
in Styria eat white arsenic in small quantities,
it increases their strength, weight, and appetite
clears their complexion. It is probable that
reason why these people can take arsenic in s
quantities is that an antitoxin is developed in t
Wood concludes that small doses of arsenic ch
tissue change and decrease nitrogenous eliminati
Large doses certainly have the opposite effect, a
cause fatty degeneration, especially of the li
stomach, and intestines; the glycogen disapp
from the liver, and the alkalinity of the blood f
owing to the formation of lactic acid. But o

knowledge of the influence of arsenic on nutrition is very imperfect, nor do we know of any action to which its beneficial effects in many diseases can be referred, but as the drug certainly in some way alters the condition of the sufferer it is vaguely called an alterative. It is eliminated chiefly by the urine, to a less extent by the alimentary canal, the sweat, the saliva, the bile, the milk, hair, cutaneous epithelium, and even the tears, but it is also stored in the body, chiefly in the liver and kidneys. It may be found many years after death in the bodies of those who have taken it during life. It can pass from the mother to the fœtus.

Excretion.—Most of it is excreted by the urine. Minute amounts pass out by the mucous membrane of the stomach, bowel, and lungs, and by the skin.

THERAPEUTICS OF ARSENICAL COMPOUNDS.

External– Formerly arsenious acid was used as a caustic to destroy growths, lupus, warts, &c., either pure or as a paste. Arsenious acid, 1 part; charcoal, 1 part; red sulphide of mercury, 4 parts; and water, q.s., is the formula of a paste once very popular. It must be used strong enough to make the mass of dead tissue slough out quickly, or else the patient becomes poisoned, for the arsenic is readily absorbed. Liquor Arsenicalis has been recommended by Ringer as an application for corns.

Internal.—*Alimentary canal.*—Arsenious acid is useful to destroy the tooth pulps before stopping teeth.

In some forms of dyspepsia small doses of the Liquor Arsenicalis are occasionally given to stimulate the appetite. Arsenic is so liable to cause sickness, diarrhœa, and other symptoms of poisoning, that it is the rule always to begin a course of it with small doses, say 3 or 4 ♏ (18 to 25 centimils) of the Liquor

Arsenicalis, or $\frac{1}{70}$ to $\frac{1}{40}$ gr. (1 to 2 milligr of arsenious acid as a pill, and graduall increase the quantity. Arsenic in any form sh always be taken immediately after meals, so a dilute it by the contents of a full stomach. Chil bear it well, old people do not. Very small doses so times check vomiting, especially that form in w the food simply regurgitates, and in excepti cases it may succeed in checking diarrhœa w other drugs have failed.

Remote effects.—Arsenic is of great valu chronic superficial skin diseases not owing their c to an irritant. It is therefore largely used psoriasis, pemphigus, and sometimes for chr eczema. It is of no use in the acute stages of t maladies, nor if cutaneous inflammation is d seated.

Cases of anæmia which cannot be cured iron, and which fall under the heading of prim anæmia, may be much improved by arsenic. these $\frac{1}{80}$–$\frac{1}{40}$ gr. (·7 to 1·5 milligrm.) of sodi arsenate dissolved in 10 ♏ (6 decimils) of w may be injected subcutaneously, but the drug usually given by the mouth. Such are pernic anæmia, splenic leucocythæmia, and Hodgk disease; but often no drug is of any avail. In ot forms of anæmia, such as chlorosis, arsenic may tried, but not often with benefit, when iron compou disagree. It often improves the metabolism, appetite, and the weight in those whose general hea is feeble. Arsenic is, next to quinine, the b antiperiodic we have, but it is not nearly efficacious. It may, however, in the absence quinine, be used for ague, and is especially valua for the anæmia which follows ague, and for neural due to the same cause. It often does distinct g in rheumatoid arthritis if given for a long while. is frequently prescribed for chorea, but it is diffic to prove that the cases get well more quickly than they would without any drug. Arsenic has been strongly recommended in asthma and in hay fever. For asthma it may be given by the mouth, or smoked as cigarettes, made by saturating bibulous paper in a solution of fifteen grains of potassium arsenite to an ounce of water. It has been given in phthisis, but without benefit. If taken with thyroid preparations it appears to diminish the liability to thyroidism. The springs of Levico and La Bourboule contain arsenious acid. The waters are sold in England, and form a convenient way of giving the drug. Strong Levico contains $\frac{1}{12}$ gr. arsenious acid and 30 grains of iron salts in a pint. Weak Levico contains $\frac{1}{120}$ and 8 gr. respectively. La Bourboule contains $\frac{1}{12}$ gr. arsenious acid and a trace of iron to the pint. These waters should be drunk at meals.

Cacodylates. (Not official.)—Arsenic has been much used in the form of cacodylate of sodium (the sodium salt of cacodylic acid $(CH_3)_2AsOOH$).

Dose, ½ to 1 gr.—30 to 60 milligrms.

The drug contains 61·8 per cent. of arsenious acid, and it is stated that large doses of it do not cause poisoning; probably because arsenious acid is very slowly formed from it in the body, and possibly much of the cacodylate is got rid of before this happens. It has not been conclusively shown to be therapeutically superior to arsenious acid. It has been given hypodermically, ¾ gr. (45 milligrms.) in 15 ♏ (1 c.c.) of water daily.

Sodium Aminophenylarsonate. (Not official.) (*Synonyms.*—Sodium aminarsonate, atoxyl, soamin, arsamin.) A white crystalline powder, soluble 1 in 6 of water.

Dose, 1 to 3 gr.—6 to 20 centigrms.—by mouth or hypodermically dissolved in water. Even 15 gr. (1 grm.) has been given for a single dose.

This compound of aniline and arsenious acid contains about 24 per cent. of metallic arsenic, but much larger doses of it than of ordinary arsenical preparations can be given without symptoms of poisoning. Lately it has been much given both alone and combined with mercurials for trypanosomiasis,

malaria, relapsing fever, and syphilis, but although in
cases benefit appears to follow it has not yet been
to definitely cure. Precisely how it acts is not known;
not affect trypanosomes outside the body. Many ca
poisoning are on record; the symptoms are dryness
throat, headache, vomiting, diarrhœa, and in some case
blindness due to optic atrophy. Injections are given
cutaneously—rarely intravenously—at intervals of 2 or 3

Sodium Acetarsenate. (Not official.) (*Synonym.*
acetin) is synthetised from atoxyl by the introduction
acetyl radicle, may be used in the same doses as atoxyl, an
the great advantage of being less toxic. It is believed tha
doses of atoxyl or arsacetin drive the trypanosomes out
blood and that then the subsequent administration of me
kills them, but both drugs are still on their trial. Solu
of arsacetin keep better and bear being sterilised better
those of atoxyl.

Salvarsan. (Not official.) *Synonyms.*—This bo
chemically dioxydiamino-arseno-benzol dihydrochloride
is often called "606" because that was its number in a
investigated.

Characters.—A bright yellow powder slowly but
pletely soluble in water. Strongly acid, contains
per cent. arsenic. It is supplied in glass tubes, first em
and then filled with an inert gas to prevent oxida
The tube should not be opened until immediately b
administration.

Dose, 0·3 to 0·6 gramme. The amount usually
tained in each tube is 0·6 grm. Mostly and certainly
given intravenously as a solution. 100 c.c. of hot, ste
freshly-distilled water are put in a sterilized glass ve
Into it the salvarsan is slowly shaken and dissolved
stirring with a glass rod. Add 4 per cent. sodium hy
solution. A precipitate forms, and, as the solution is sl
added, it redissolves. When this happens, make up
total bulk to 200 c.c. by the addition of warm normal sa
made with freshly-distilled water. Inject the fluid into a
at the bend of the elbow with any of the various apparat
such a temperature that when it enters the vein it is a
100° F. (38° C.). The patient should be in bed for 24 h
before injection. During this time he should have his bo
well opened, and have only light diet. During injection
should be recumbent, and must remain in bed, on l
diet, for 24 hours after injection. The operation must

strictly aseptic. Often there is soon after it slight pyrexia for a few hours; but severe symptoms—as considerable pyrexia, rigors, vomiting, and diarrhœa—can be avoided if every one of the above detail is observed, especially the use of freshly-distilled water; for after distilled water has stood in the laboratory some time bacteria appear in it, and even if then sterilized before use, it contains the dead bodies of them and it is these dead bacteria which are thought to be the cause of the pyrexia and other symptoms which may follow the use of salvarsan.

When given intramuscularly, the dose of salvarsan is shaken into 10 c.c. of warm distilled water; 6 c.c. of 4 per cent. sodium hydrate solution is added, and then 6 per cent. acetic acid till the mixture is just acid; then a drop of sodium hydrate solution is added, so that when injected it is just alkaline. It is then injected intramuscularly into the gluteal muscles or into the scapular muscles. Occasionally this leads to painful swelling, and intravenous injection is much to be preferred to intramuscular. It should never be given subcutaneously and should never be ordered for any patient who has heart disease, renal disease, phthisis, or arterial disease, although some have given it to such patients in minute doses. For further details special works must be consulted. Usually one, two or three doses are given at intervals of one or two weeks.

ACTION AND THERAPEUTICS.

A syphilitic chancre, a secondary syphilide or ulceration, or a tertiary gumma or ulceration, generally improves extraordinarily rapidly after a dose of salvarsan. Syphilitic lesions that have been visible for months will disappear in a few days. It is of use in acquired or congenital syphilis, but in parasyphilitic affections it has not been yet proved to be of great benefit, but it may prevent their progress. The use of salvarsan causes the syphilitic spirochetes to disappear and the Wassermann reaction becomes negative. Sometimes a transient rise of temperature follows. It should not be given if the patient is suffering from any serious disease other than his syphilis. Sufficient time has not yet elapsed for us to be sure that syphilis is permanently cured by salvarsan, and probably it is wise after the inj of salvarsan to give a two or three years' cou mercury. Salvarsan (0·1 grm., water 30 ♏ (2 glycerin ½ fl. oz., 15 mils) has been used with h as a local swab for chronic ulcerations of the n

Neo-salvarsan. (Not official.) A condensatio duct of formaldehyde sulphoxylate of sodium and salv Known as No. 914. A yellow powder. Has the great tage over salvarsan of being freely soluble in water, forn neutral solution. 1·5 grm. neo-salvarsan equals 1 grn varsan. A usual dose is 1 grm dissolved without he and with very little shaking, in 200 c.c. of distilled water intravenously. It is often given intramuscularly. believed to be as efficacious for syphilis as salvarsan.

TOXICOLOGY.

Acute Poisoning.—White arsenic is frequently u a poison. Soon after taking it the sufferer experiences ness, nausea, sickness, epigastric pain and tenderness. symptoms quickly increase. The vomit is brown, and streaked with blood; the pain is very severe; there is p diarrhœa, with much tenesmus; and there are cramps i calves of the legs. The vomiting becomes violent and sant; there is a burning sensation in the throat, with in thirst. Soon severe collapse sets in; the skin is col pulse small and feeble, and the patient dies collapsed. symptoms frequently bear a close resemblance to the cholera. *Post mortem.* The stomach is intensely infla even if the arsenic has not been taken by the mouth, bu been applied in large quantities to cancerous growths. shows that arsenic is excreted from the blood into the stom The small intestines are also acutely inflamed.

Treatment.—Wash out the stomach. Give emetics (p. choosing the least irritating and least depressing. The sto must be completely emptied. Give unlimited quantiti freshly prepared humid peroxide of iron (p. 204) or dia iron (p. 204). If neither of these is handy, give mag in large amounts, or large doses of castor oil and w Give brandy or ether subcutaneously; apply hot blanket bottles to the feet and the abdomen.

Chronic Poisoning.—Often, when arsenic is tak a medicine, slight symptoms of poisoning are seen. The loss of appetite, nausea, perhaps vomiting, slight abdom pain, and mild diarrhœa. The eyelids become a little p [illegible] conjunctivæ injected, the eyes and nose water, and there is headache. These symptoms, of course, show that the [illegible] given is too large, and that it must be decreased.

Arsenic is so often used in the manufacture of all sorts of articles, especially wall papers and fabrics, that chronic poisoning by it is frequently seen. It is also met with in [illegible] in arsenic, and in persons to whom it has been given with intent to murder. The symptoms produced are those [illegible] mentioned as present when large doses of arsenic are [illegible] medicinally.

Long-continued use of arsenic may induce peripheral neuritis. The chief symptoms of arsenical neuritis are herpes [illegible] paralysis of the muscles of the limbs, especially the [illegible] of the hands and feet, ataxic gait, severe darting [illegible] in the limbs, and rapid muscular atrophy. Several cases [illegible] recorded in which arsenic has caused general brown pigmentation of the skin, best marked about the neck. Very rarely [illegible] forms on the mucous membrane of the mouth. It may [illegible] rise to a general increase of epidermic scales (keratosis), and to brown pigmentation of patches of psoriasis, and in exceptional cases cause eczema or urticaria. The [illegible] may be silvery. After death from chronic poisoning, in addition to the gastro-intestinal and nervous lesions, there is widespread fatty degeneration of most of the organs of the [illegible]. It is well seen in the liver, kidneys, stomach, and [illegible], including the heart.

Repeated doses given to animals abolish the glycogenic [illegible] of the liver, and puncture of the floor of the fourth [illegible] no longer causes glycosuria. In frogs poisoned with [illegible] the epidermis peels off very easily. This is due to degeneration of its lower cells, the degeneration proceeding [illegible] the lowest layer outwards.

ANTIMONIUM.

Antimony. Symbol, Sb. Atomic weight, 120·2.

(Not official.)

1. Antimonium Sulphuratum. Sulphurated Antimony. A mixture of antimony sulphides and antimony [illegible].

SOURCE.—Boil antimonious sulphide with sublimed sulphur and solution of soda, and precipitate with sulphuric acid.

CHARACTERS.—A dull-red powder, insoluble in water.

Dose, 1 to 2 gr.—6 to 12 centigrms.

Contained (1 part in 4½) in Pilula Hydrargyri Subchloridi Composita.

2. Antimonii Oxidum. — Antimonious
Sb_2O_3.

SOURCE.—Pour a solution of antimonious chlorid
water. The antimonious oxychloride is precipitated.
precipitate is treated with sodium carbonate, and the
washed and dried.

CHARACTERS.—A greyish-white powder, insoluble in

IMPURITIES.—Higher oxide.

Dose, 1 to 2 gr. 6 to 12 centigrms.

Preparation.

Pulvis Antimonialis. — A substitute
"James's powder." Antimonious oxide, 1; ca
phosphate, 2.

Dose, 3 to 6 gr. 2 to 4 decigrms.

3. Antimonium Tartaratum. Tartrate
timony, or Potassio-tartrate of Antimony. $(KSbO,C_4H$
H_2O. *Synonym.* Tartar emetic.

SOURCE.—Prepared by setting aside a mixture of
monious oxide and acid potassium tartrate, made into a
with a little water until combination has taken place
purifying by crystallization.

CHARACTERS.—Colourless transparent crystals with
gular facets. *Solubility.*—1 in 17 of cold, 1 in 3 of bo
water. The solution is faintly acid.

INCOMPATIBLES.—Gallic and tannic acids, most astrin
infusions, alkalies, lead salts.

IMPURITY.—Acid tartrate of potassium.

Dose, [illegible] to [illegible] gr. 2·5 to 8 milligrms.; ½ to 1
(emetic)—3 to 6 centigrms.

Preparation.

Vinum Antimoniale. Tartarated antim
4; boiling distilled water, 40; sherry, to make 10

Dose, 10 to 30 m. 6 to 18 decimils, 2
fl. dr.—8 to 16 mils, as an emetic.

ACTION.

External.—Antimonial compounds are powe
external **irritants.** Tartar emetic produces **a pustu**
eruption at the point of application.

Internal. *Alimentary canal.*—All compound
antimony are powerful **irritants,** internally as

as externally; the action of **tartar emetic** is best known. The first result of swallowing this is **vomiting.** The early acts of vomiting are entirely due to the direct action of the drug on the wall of the stomach, but it is quickly absorbed, and by its action on the medulla it also produces sickness; but this action is slight. It will produce vomiting when injected into the blood, partly by its action on the medulla for it will act if the stomach is replaced by a bladder but also because some of it is excreted into the stomach and intestines, and thus the vomiting is continued for some time. In large doses **tartar emetic is irritant to the intestine.**

Heart. Antimony acts upon man as upon the lower animals. It is a powerful **cardiac depressant,** diminishing both the frequency and the force of the beat of the heart. Experiments on animals have shown that the final stoppage takes place in diastole, and that the chief action of antimony is that of a direct depressant to the cardiac muscle itself. Of course the cardiac depression causes the arterial pressure to fall, but part of this effect is due to a independent action upon some portion of the vaso-motor system: the probability being that antimony, paralysing the muscular coat of the arteries, relaxes them.

Respiration. Respiration is depressed the movements become weaker, and inspiration is shortened, but expiration is prolonged. Finally, the pauses become very long and the movements very irregular. The cause of this is not known; probably it is very complex.

Nervous and muscular systems.—Here also antimony acts as a **powerful depressant**, especially to the spinal cord, and to a less extent to the brain; hence moderate doses cause **a feeling of languor, inaptitude** for mental exertion, and sleepiness. Experiments on animals show that after the administration of large doses of antimony reflex movement is soon

lost, and that this is due to a depressing effec
the sensory part of the spinal cord. This dep
sant influence is felt also in the muscles, and h
antimony will relieve spasm, but whether it doe
by direct action on the muscles, or by acting
the nervous system, is doubtful.

Temperature.—Moderate doses of antimony h
little influence on the temperature, but large d
cause a **considerable fall**, due, no doubt, in the m
to the circulatory depression, but also, it is said,
direct action in decreasing the amount of heat produ

Excretion. Antimony is excreted by the ur
bile, sweat, bronchial secretion, milk, and particula
by the fæces. We have seen that part of its em
effect is due to its excretion into the stomach.
it passes out by the bronchial mucous membrane
increases the amount of secretion, and thus acts
an **expectorant.** On the skin its action is that
a profuse **diaphoretic.** This is chiefly a second
result of the depression of the circulation, but it
possibly in part a direct local effect. In frogs t
action on the skin is very like that of arsenic, b
antimony softens rather than detaches the epiderm
which thus becomes a jelly-like mass. Being e
creted in the bile, it perhaps aids its flow; therefo
it may be a **cholagogue.**

In passing through the kidneys it may be slight
diuretic, but this depends upon the amount of pe
spiration produced by it. If its use is continu
for some time it will cause, like arsenic, fatty degen
ration, especially of the liver, and abolition of th
hepatic glycogenic function.

THERAPEUTICS.

External.—Many years ago an ointment of tarta
emetic was commonly applied as a counter-irritan
but it causes much pain, and is now seldom used.

Internal.—*Alimentary canal.*—Tartar emetic is not to be recommended as an emetic, for the action is slow, and the general depression of emetic doses is great. For this reason it should never be given to produce purgation. The only cases in which it is permissible are those in which an emetic is required for laryngitis, bronchitis, or some other acute inflammatory condition of the respiratory tract, for then its depressant action on the circulation may perhaps be beneficial, but usually ipecacuanha is preferable.

Circulation.—Antimony was formerly largely employed, especially in combination with aconite, to reduce the force and frequency of the pulse in all sorts of febrile conditions, but this is now generally thought unnecessary. If it is to be used it is especially indicated in respiratory affections, for then its expectorant effect may be valuable.

Respiration.—It has been very much given for the early stages of acute bronchitis, but certainly it should not be continued after a free secretion of bronchial mucus has been set up by it. After that it is, on account of its depressing influence, an undesirable expectorant.

Nervous and muscular systems.—Its use as a sedative in delirium tremens is now abandoned, and the introduction of chloroform has made it unnecessary to employ tartar emetic to relax muscular spasm in herniæ and dislocations.

Remote effects.—Occasionally it is given in fevers for its diaphoretic influence, and for its slight antipyretic action. Sometimes it is ordered as a cholagogue, but because of its powerful depressant action it is less used as a medicine than formerly.

TOXICOLOGY.

Acute Poisoning. The symptoms are very like those of arsenical poisoning (p. 234). *Post mortem.* The gastro-intestinal irritation is very similar, but it is not nearly so marked.

Treatment.—Unless the vomiting is very free, ap phine subcutaneously, or zinc sulphate by the mou the stomach-pump may be used. Also frequent do half a drachm of tannic or gallic acid dissolved in strong tea or coffee, mucilaginous drinks, and stim subcutaneously. Hot water bottles and warm blankets n necessary.

Chronic poisoning is not sufficiently common t for notice here.

CHROMIUM.

Symbol, Cr. Atomic weight, 52. (Not official.)

1. Acidum Chromicum. Chromic Acid. Chr anhydride. CrO_3.

Source. Prepared from potassium bichromate by action of sulphuric acid.

Characters.—Crimson acicular crystals, very deli cent, soluble in water. Readily yields oxygen, and will t fore easily explode. It does so with either glycerin or alc

Preparation.

Liquor Acidi Chromici.—Chromic acid, water, to 100.

Action.

External.—In consequence of its oxidizing po chromic acid is a powerful deodorant and disin tant. It coagulates albumen and oxidizes orga matter, and is therefore a powerful **caustic.**

Internal.—None is known.

Therapeutics.

External. As a lotion, 1 in 40, or even strong chromic acid has been used for its disinfect properties to wash foul ulcers and sores, and also a local application for ozæna, gonorrhœa, leucorrh and bad ulceration of the mouth, but a gargle sho contain only a grain in a fluid ounce. The pharm copœial **liquor** is occasionally used as a **caustic** **destroy condylomata.**

2. Potassii Bichromas.—Potassium Bichromate. $K_2Cr_2O_7$.

SOURCE.—Prepared from chrome ironstone by roasting with lime in the presence of air, treating the resulting chromate with a potassium salt and subsequently with an acid.

CHARACTERS.—Large orange-red transparent triclinic crystals. *Solubility.*—1 in 10 of water.

INCOMPATIBLES.—Owing to the ease with which it oxidizes it readily forms explosive compounds. Hence it is best prescribed with kaolin or in capsules.

Dose, $\frac{1}{10}$ to $\frac{1}{5}$ gr.—6 to 12 milligrms.—in capsules, or as a pill with kaolin.

ACTION AND THERAPEUTICS.

Occasionally solutions of potassium bichromate have been taken by mistake. Symptoms of very severe gastro-intestinal inflammation with much collapse have followed. Handling the salt frequently may produce eczema. Its solution is caustic and antiseptic, but it is weaker than chromic acid. Potassium bichromate is said to be useful for gastric catarrh and gastric ulcer; it is best given on an empty stomach thrice a day.

The remaining groups of the inorganic drugs are non-metallic.

GROUP VIII.

Containing **Phosphorus** only.

PHOSPHORUS.

Symbol, P. Atomic weight, 31·04. (Official.)

SOURCE.—Obtained from calcium phosphate.

CHARACTERS.—A wax-like solid, freely soluble in carbon bisulphide, sparingly soluble in alcohol, ether, and chloroform, 1 in 80 in olive oil or melted fat, insoluble in water; luminous in the dark. Must be kept under water, as

it oxidizes and takes fire very easily. Heated with h gen it forms red or amorphous phosphorus, which is poisonous, as it is so insoluble that it cannot be absorbe

Dose, $\frac{1}{100}$ to $\frac{1}{25}$ gr.—0·6 to 2·5 miligrms.—ir or solution.

Preparations.

1. Oleum Phosphoratum.—1 of phospl dissolved at 80°C. in 98 of almond oil, which must be heated to 150°C. and filtered to remove wate organic matter, for this would otherwise oxidize phosphorus; 1 of oil of lemon is finally added. preparation is very nasty. *Strength.*—1 per cent.

Dose, 1 to 5 m.—6 to 30 centimils (gelatin capsule).

2. Pilula Phosphori.—Phosphorus, 1; o theobroma, 40; wool fat, 11; kaolin, 16; so sulphate, 32; carbon disulphide, 20. *Strengt* 1 per cent. of phosphorus.

This pill should be freshly prepared. It is half the strength of the corresponding pill B. P. 1

Dose, 1 to 4 gr.—6 to 25 centigrms.

ACTION.

The only known action of minute doses of ph phorus is that in animals the spongy tissue the bones is thickened by the deposition of t bone of normal composition, and the compact tis is rendered more dense. If rather larger, freque repeated doses are given for some time, prolife tion of the interstitial connective tissue of stomach, liver, and kidney is also found. With s larger doses fatty degeneration is produced, as scribed under Toxicology. Phosphorus enters blood as phosphorus, and acts as such, not phosphoric acid. It is eliminated in the urine phosphates. Elixir Phosphori (B. P. C.)—**dose, to 60 m.** (1 to 4 mils)—is the best fluid preparati

THERAPEUTICS.

It has been used in osteomalacia, in rickets, and in cases of ununited fracture, but for rickets at least it is a very inferior remedy, and it is probably of little use in medicine.

TOXICOLOGY.

Acute Poisoning.—Phosphorus is often taken, or administered criminally, either as match heads or vermin paste. For the first few hours there are no effects, then the following symptoms of gastro-intestinal irritation set in:—Nausea, abdominal pain, and vomiting; the vomited matters smell of phosphorus and are luminous. There is some general depression. Diarrhœa is rare. The patient may die of collapse, but far more frequently these symptoms all pass off and he appears quite well. But after three or four days jaundice is noticed, and this soon becomes very deep; there is now great prostration, the liver is enlarged, the abdomen is distended, and he complains of intense thirst. Vomiting of altered blood and diarrhœa with bloody stools may be observed, but these two symptoms are not severe. The skin is cold, the pulse feeble and rapid. The urine is scanty, highly coloured, albuminous, bile-stained, and perhaps bloody; it contains the acetone bodies and lactic acid, and in the final stages may contain bile acids and crystals of leucin and tyrosin. There is an excessive protein metabolism as shown by the increase of sulphates, phosphates, and nitrogen in the urine. This last comes from the excess of ammonia which is formed in the protein tissues and poured into the blood to neutralize the lactic acid and the acetone acids, which appear because phosphorus prevents the complete oxidation of glycogen, fat, and the non-nitrogenous results of protein break-down. This incomplete oxidation leads to the accumulation of fat in the liver and the muscles which undergo fatty degeneration. Muscular twitchings occur, the patient becomes comatose and dies. *Post mortem.*—Two results are very striking. (1) Fatty degeneration (thus phosphorus resembles arsenic and antimony), affecting principally the liver, in which it is very marked; and if the patient lives long enough there may be a diminution in size of the organ. Fatty degeneration is also found in the muscles, kidneys, and gastro-intestinal tract. (2) Hæmorrhages are seen in many places, and ecchymoses are sometimes very abundant. If they occur in the gastric and intestinal mucous membranes

they may give rise to the erroneous belief that evidenc
acute gastro-intestinal irritation can be found at death.
symptoms of phosphorus poisoning in many respects rese
those of acute yellow atrophy of the liver.

Treatment. — Thoroughly empty the stomach
stomach-pump or by washing it out. Give copper
phate as an emetic (*see* p. 184), three grains (2 de
every few minutes till vomiting is induced, then
15 minutes; also half a drachm of oil of turpentine
every half-hour. A full dose of a saline purge ma
administered. No other oils or fat should on any acc
be given.

Chronic Poisoning. This, which used to be se
those who worked among phosphorus fumes, is now of
rarity. The chief symptoms are those of gastro-intes
irritation and necrosis of the jaw. This Stockman has s
to be due to the fact that the phosphorus fumes, when
gum is broken, gain access to the bone and lower its vit
so that it easily becomes the seat of tubercular dis
Sufferers from phosphorus necrosis often die from ge
tuberculosis.

1. Calcii Hypophosphis. Calcium Hypop
phite. $Ca(PH_2O_2)_2$.

Source. Heat phosphorus with slaked lime and w

Characters. White pearly crystals, with a bitter
seous taste. *Solubility.* — 1 in 8 of cold water.

Dose, 3 to 10 gr. 2 to 6 decigrms.

2. Sodii Hypophosphis. Sodium Hypop
phite. $NaPH_2O_2$.

Source. — Add sodium carbonate to a solution of
cium hypophosphite and evaporate.

Characters. A white granular salt with a bitter t
Solubility. — 1 in 1 of water.

Dose, 3 to 10 gr. — 2 to 6 decigrms.

THERAPEUTICS OF HYPOPHOSPHITES OF CALCIU AND SODIUM.

These drugs have been recommended for phthi
but although in some cases they appear to have d
good there is no satisfactory evidence of their val
Hypophosphite of iron is often prescribed (dose, 1

5 gr., 6 to 30 centigrms., slightly soluble in water). All three hypophosphites are best given dissolved in water and syrup. The Syrupus Hypophosphitum Compositus (B. P. C.), dose ½ to 2 fl. dr. (2 to 8 mils), contains those of iron, potassium, quinine, calcium, and manganese, together with $\frac{1}{160}$ gr. (0·4 milligrm.) of strychnine in each drachm. This is a popular general tonic. It should be remembered that hypophosphites explode if heated. Calcium Lactophosphate is described on p. 163.

Glycerophosphates. (Not official.) Calcii Glycerophosphas (dose, 3 to 10 gr., 2 to 6 decigrms., soluble in water) is most used. Ferri Glycerophosphas (dose, 1 to 5 gr., 6 to 30 centigrms., sparingly but sufficiently soluble in water) is a useful salt. Glycerophosphates have been much given to persons who from overwork or disease are run down, weary, and easily tired, and certainly in some cases they are of benefit. They are best given in an ounce of water flavoured with syrup, and taken directly after meals thrice daily. Many other glycerophosphates, besides the above, are in the market. An excellent preparation is the Syrupus Glycerophosphatum Compositus (B. P. C.), dose 1 to 2 fl. dr. (4 to 8 mils). It contains glycerophosphates of calcium, potassium, sodium, magnesium, and iron, with citric acid, caffeine, and strychnine. There are in the market many preparations of casein associated with glycerophosphates. *Vitafer* is an example. The preparation *Sanatogen* is sodium glycerophosphate of casein. Tunnicliffe's researches appear to show that the phosphorus of glycerophosphates is absorbed and retained in the body.

GROUP IX.

Chlorine, Iodine, Bromine.

These elements, which are chemically so closely allied, are all of them powerful disinfectants and irritants.

CHLORINE.

Symbol, Cl. Atomic weight, 35·46.

This gas is not official under its own name, but it is officially obtained from chlorinated lime and chlorinated soda, and acidum nitro-hydrochloricum dilutum contains free chlorine.

1. Calx Chlorinata.—Chlorinated Lime. CaC $CaCl_2$. *Synonym.*—Bleaching powder.

Source.—Pass chlorine gas over slaked lime.

Characters.—A dull white powder, smelling of chlo which it evolves on addition of an acid or on exposure t for it absorbs carbonic acid gas. Contains 33 per cent. of a able chlorine.

Preparation.

Liquor Calcis Chlorinatæ.—1 of chlorin lime shaken up with 10 of water. Yields 3 per c of chlorine.

2. Liquor Sodæ Chlorinatæ.—Solution Chlorinated Soda.

Source.—Mix a solution of sodium carbonate with of chlorinated lime.

Characters.—A colourless liquid with an odour of c rine. It is a mixture of chloride, hypochlorite, and carbo of sodium. Contains 2·5 per cent. available chlorine. To preserved in a cool, dark place.

Dose, 10 to 20 m. 6 to 12 decimils.

ACTION.

External.—Chlorine is one of the most power **disinfectants** and **deodorizers.** It has a very gr affinity for hydrogen, and hence decomposes co pounds which contain hydrogen, oxygen genera being set free. Chlorine is a very active and d structive **irritant** to the skin and mucous membran

Internal.—It is hardly ever given internall If it were, it would become converted into chlorides

THERAPEUTICS.

External.—Chlorine is largely used in the for of chlorinated lime to disinfect privies, drains, urinal &c. It may be employed also to disinfect rooms aft infectious diseases. All metals or articles, such a fabrics, likely to be bleached, should be covered u or removed; the windows and chimneys should b pasted up. The gas can be evolved from common sal black oxide of manganese, and sulphuric acid. Th door is then shut, and the cracks around it are pasted over with paper. Chlorine water is sometimes employed as a wash for foul ulcers and discharges. Labarraque's solution is a solution of chlorinated soda one fourth the strength of the B. P. preparation.

Internal.—Chlorine is used internally for the mouth. A gargle (Gargarisma Chlori, B. P. C.), containing free chlorine is very useful for syringing and rinsing the fauces and nose in scarlet fever and other septic conditions of the mouth. This gargle is made by putting 200 gr. of potassium chlorate in a dry bottle, pouring on 40 ♏ of hydrochloric acid, set aside, loosely corked for 10 minutes, then a pint of water in 4 or 5 successive portions, shaking each time. This gargle is usually employed diluted with an equal part of water. It must be quite recently prepared. The vapour of chlorine gives rise to great irritation of the respiratory tract, and should never be inhaled.

IODUM.

Iodine. Symbol, I. Atomic weight, 126·92. (Official.)

SOURCE.—Obtained from the ashes of seaweeds and from mineral iodides and iodates.

CHARACTERS. Rhombic prisms or octahedrons, with a peculiar odour and dark colour, giving a violet vapour on heat. *Solubility.* 1 in 5000 of water; freely in alcohol (90 per cent.), ether, chloroform, a solution of potassium iodide or sodium chloride.

INCOMPATIBLES.—Metallic salts, mineral acids, alkaloids, of turpentine, and ammonia; with the last two explosive compounds may be formed.

IMPURITIES.—Cyanogen iodide, iron, water.

Preparations.

1. **Tinctura Iodi Fortis.**—Iodine, 10; potassium iodide, 6; water, 10; alcohol (90 per cent.), to

produce 100. *Strength.*—0·1 grm. of iodine in
millilitre; $\frac{1}{11}$ gr. in 1 ♏. This corresponds to Lini
tum Iodi, B. P. 1885, and contains the same propo
of iodine as the Liquor Iodi Fortis, B. P. 1898.

2. Tinctura Iodi Mitis.—Iodine, 1; potas
iodide, 1; water 1; alcohol (90 per cent.), to pro
40. *Strength.*—0·025 grm. in each millilitre; $\frac{1}{44}$
1 ♏. This contains the same proportion of iodi
Tinctura Iodi, B. P. 1898.

Dose, 2 to 5 ♏. 12 to 30 centimils.

3. Unguentum Iodi.—Iodine, 1; potas
iodide, 1; glycerin, 3; prepared lard, 20. *Streng*
4 per cent. of iodine. In India prepared suet sh
be used instead of prepared lard.

ACTION.

External.—The actions of iodine applied ex
nally are the same as those of chlorine, that is
say, it is powerfully **disinfectant and irritant.**
latter action is the most important. Iodine app
to the skin produces a yellow stain, which
be removed by an alkali or sodium hypo
phite. At the same time it causes a sensation
heat and burning, dilatation of the vessels (ru
faction), some œdematous swelling, and so
exudation of leucocytes, to which its energ
absorbent action is partly due. There often
an accumulation of fluid under the epider
forming a vesicle. Preparations of iodine are rar
used strong enough to produce more powerful ir
tation than this. The external application of the
probably reflexly contracts the vessels of the su
jacent organs, and this may explain their use
counter-irritants. If they are too strong, the irrit
tion set up by them will proceed to the formation
pustules, and deep inflammation with scarrin
They usually destroy the superficial cuticle, so th
after the use of them the skin peels. Iodine ma
be absorbed from the skin, and the alkalies of th

blood serum lead to the formation of sodium iodide and sodium iodate; thus

$$6NaHCO_3 + 3I_2 = 6CO_2 + 3H_2O + 5NaI + NaIO_3.$$

These, when they meet an acid, undergo double decomposition; thus

$$5NaI + NaIO_3 + 3H_2O = 6NaHO + 3I_2.$$

Thus **free iodine** is formed in the stomach and kidneys, and so if iodine has been applied to too large an area we get gastro-intestinal irritation and vomiting. The same may happen if it is taken by the mouth, and it may cause precisely the same symptoms of iodism as potassium iodide (p. 253). Iodine preparations are **parasiticide** to the various vegetable and animal parasites which infest the skin.

Internal.—Minute doses of the tincture occasionally stop vomiting. In the stomach iodine is converted into iodides; what is known of their action will be described presently. The vapour is very irritating to the respiratory passages. Iodine, bromine, and chlorine all cause rigor mortis and an acid reaction in the muscles of frogs.

THERAPEUTICS.

External.—Iodine is rarely employed for its antiseptic properties, as chlorine is cheaper, except that it is constantly used as a paint for the skin before operations. The preparations of iodine are in constant use as irritants and counter-irritants, and are frequently used as counter-irritants for chronic inflammation of joints, for pleurisy, chilblains, periostitis, and many other purposes. The mild preparations of iodine are applied over chronically inflamed lymphatic glands when the cause of the swelling cannot be removed. A decolorized tincture of iodine is prepared, consisting of iodine dissolved in rectified spirit, and decolorized by a strong solution of ammonia. Its strength is about 1 in

40 nearly. It is a B. P. C. preparation, has the advantage of not staining the skin, b contains no iodine, for iodide and iodate of an nium are formed. Therefore it is a much m irritant than other iodine preparations. Any e it may have is due to excess of ammonia. The v tincture, or, if it can be borne, the strong, is c used as an antiparasitic for ringworm. Cos paste, which is sometimes employed for this dise consists of 120 grains (8 grms.) of iodine disso in 1 fl. oz. (30 mils) of light oil of wood tar. Mort fluid, which was formerly used as an injection spina bifida, consists of iodine 10 grains (6 decigrm potassium iodide 30 grains (20 decigrms.), glyc 1 fl. oz. (30 mils).

Internal.—The vapour of iodine is occasion inhaled for diseases of the lungs, but it probably c more harm than good. One or two minims of the w tincture in half an ounce of water are often giv quite empirically, every half-hour in cases of vor ing, and sometimes with distinct benefit. Prepa tions of seaweed have among uneducated person reputation for reducing obesity. If they have such action it is probably because the iodine, chlori and bromine in them set up such dyspepsia that proper digestion and absorption of food are prevent Extracts of *Fucus vesiculosus*, the bladderwrack seawrack, have been used, and are the basis of so quack preparations.

Iodipin.—(Not official.) *Synonym.*—Jodipin, Iodi

Dose (of 25 per cent. preparation), **30 to 60 m.** (**2** **4 mils**) by mouth, subcutaneously or intramuscularly.

A compound of iodine and sesame oil prepared repeatedly iodizing the oil by iodine monochloride. It thick yellow oil similar to bromipin (*see* p. 261), and strength usually sold contains 25 per cent. of iodine. I used for tertiary syphilis as is potassium iodide (*q.v.*). T above mentioned doses may often be greatly exceeded wi [illegible] Iodipin may be given by inunction, or if by the mouth as an emulsion. A 10 per cent. compound is pre- [illegible] may be used in corresponding doses.

1. Potassii Iodidum. Potassium Iodide. KI.

SOURCE. Dissolve iodine in liquor potassæ. Evaporate and heat the residue with charcoal, the oxygen of the iodate being carried off as carbonic oxide. Dissolve in boiling water, filter, wash, and crystallize.

CHARACTERS. Whitish opaque cubical crystals having a saline taste, without odour if pure. *Solubility.*—4 in 3 of water; 1 in 12 of alcohol (90 per cent.); 1 in 3 of glycerin.

INCOMPATIBLES. Bismuth subnitrate, sweet spirits of nitre, liquorice, preparations containing starch.

IMPURITIES.—Iodates.

Dose, 5 to 20 gr.—3 to 12 decigrms.—or more.

Preparations.

1. Linimentum Potassii Iodidi cum Sapone. Potassium iodide, 30; curd soap, 40; glycerin, 20; oil of lemon, 2; water, 200.

2. Unguentum Potassii Iodidi. Potassium iodide, 10; potassium carbonate, 0·6; water, 9·4; benzoated lard, 80.

In India, benzoated suet should be used instead of benzoated lard.

Potassium iodide is contained as a solvent in all pharmacopœial preparations of iodine.

2. Sodii Iodidum. Sodium Iodide. NaI.

SOURCE. Made from a solution of soda, as potassium iodide is made from a solution of potash.

CHARACTERS. A white, deliquescent, crystalline powder, with a saline taste. Freely soluble in water, glycerin, and alcohol.

Dose, 5 to 20 gr.—3 to 12 decigrms.

3. Acidum Hydriodicum Dilutum. Diluted Hydriodic Acid. It is an aqueous liquid containing, when fresh, 10 per cent. by weight of hydrogen iodide, HI, and 1 of hydrogen hypophosphite, HPH_2O_2.

SOURCE.—Obtained by the action of hydrogen sulphide on a solution of iodine with the subsequent addition of hydrogen hypophosphite.

CHARACTERS.—A clear, colourless liquid.

INCOMPATIBLES.—Alkalies and their carbonates, met
oxides, salts of silver and lead.

Dose, 5 to 10 ♏—3 to 6 decimils.

Preparation.

Syrupus Acidi Hydriodici.—Diluted hydr
acid, 10; distilled water, 5; syrup to produce 100
Dose, ½ to 1 fl. dr.—2 to 4 mils.

ACTION OF IODIDES.

External.—They have none. They do not
tate, and they are absorbed by the unbroken ski
very small quantities.

Internal.—There is much uncertainty about
action of iodides, and several views have been
forward. The best known is that of Binz, w
teaches that they are decomposed in the b
by small quantities of nascent oxygen (set free
living protoplasm) acting upon an iodide which i
an acidulated solution, the acid being provided
carbonic acid. Thus

$$KI + H_2O + CO_2 = KHCO_3 + HI$$

and then

$$2HI + O = H_2O + I_2.$$

We have just shown that iodine acts as an abso
ent and that it leads to leucocytosis; and that iodi
act in virtue of the iodine set free from them in
body is supported by the fact that the older physicia
produced the same therapeutic effects by giving iod
internally as we procure with iodides, and that iod
taken internally will produce symptoms of iodis
Potassium iodide replaced iodine in therapeut
because it does not cause the same gastro-intesti
irritation. The beneficial effects of iodides are so ve
marked in syphilis that in this disease they must ha
some specific action in addition to their general pow
as absorbents. They also have a specific effect on t

mammary gland, for they lessen the secretion of milk. Long-continued large doses they cause atrophy of the testicles and breasts. Some believe that they aid the elimination of lead, and this may be due to the fact that albuminate of lead is soluble in solutions of potassium iodide. Occasionally a well-marked feeling of general depression is produced by large doses of potassium iodide. It has recently been conclusively shown that neither iodide of potassium nor that of sodium produces any effect on the heart or blood-vessels. Iodides are rapidly eliminated by the urine, saliva, sweat, and mucous membranes. When taken in excess they produce a number of symptoms known as Iodism.

Iodism. The patient complains of heavy pain over the frontal sinus, running at the nose, sore throat, increased secretion of saliva, and an eruption on the skin, consisting of patches of erythema. In rare cases there is albuminuria. The inflammation about the fauces may spread to the gums or down the trachea, setting up laryngitis, tracheitis, and bronchitis. These symptoms have been ascribed to an excessive formation of free iodine formed as mentioned above—and this is supported by the fact that they can be checked by large doses of sodium bicarbonate, which keep the fluids of the body alkaline and thus prevent the formation of free iodine and also the decomposition of iodides by nitrites, for minute traces of these are believed to exist in saliva, nasal and bronchial mucus, and sweat, and they will liberate free iodine from potassium iodide. It is stated in support of this view that sulphanilic acid (dose, 60 to 90 gr., 4 to 6 mils), which forms a very stable compound with nitrous acid, will prevent iodism. The susceptibility of people to poisoning by iodides varies very much. Iodates, a rare impurity of iodides, may perhaps by their tendency to liberate iodine cause iodism.

Therapeutics of Iodides.

The most important use of iodides is for syph their value for the primary and secondary s is comparatively slight, but they are inval for the tertiary stages, as they often cause the absorption of nodes, gummata, and other syph deposits. The pharmacopœial dose may ofte exceeded: patients sometimes take two, thre even four drachms a day. Large doses are espec used in syphilis of the nervous system. Potas iodide is often prescribed with perchloride of cury. The biniodide is formed and dissolved in excess of potassium iodide.

Chronic rheumatoid arthritis is often treated, sometimes with benefit, by small doses of potass iodide continued for a long while, but probably io of iron is more useful. Gonorrhœal rheuma is often treated with potassium iodide. It quently aids the absorption of chronic inflamma products, even when they are not syphilitic. There certain forms of joint disease, of pleurisy, and of monary consolidation sometimes yield to treatm by this drug. It has been applied successfully means of cataphoresis to parts affected with chro rheumatism. It often benefits some forms of go and increases the amount of iodine in the thyro The attempt has been made to cure aneury which are inaccessible to surgery by giving potassi iodide for long periods, for it is thought tha aids the coagulation of blood in them; but as at same time the patient is always kept in bed, it difficult to say how much of any improvement t may happen to take place is due to the iodi Frequently it relieves the pain of aneurysm angina pectoris. It is a valuable expectorant, a sometimes cures cases of bronchitis when oth remedies have failed. Chronic Bright's disease h been treated with this drug. Lardaceous disease of the kidneys and other organs is benefited by it. It is recommended for asthma, and in some cases does much good, either given by the mouth, or as one of the numerous proprietary liquid inhalations used for asthma, many of which contain iodid of potassium, acetone and glycerin. It is occasionally given to decrease the secretion of milk. Potassium iodide perhaps causes a slightly increased excretion of both lead and mercury if they exist in the body, and it is therefore occasionally given in cases of chronic poisoning by these metals.

Sodium iodide is not so much used, but it probably produces the same effects as the potassium salt. Ammonium iodide (dose, 3 to 20 gr.) may be given if the potassium salt causes depression, and it is said that rubidium iodide (dose, 5 to 20 gr.) is sometimes better tolerated than potassium iodide.

Diluted hydriodic is usually given when alkaline iodides disagree and in the form of Syrupus Acidi Hydriodici. This is an excellent preparation for children.

BROMUM.

Bromine. Symbol, Br. Atomic weight, 79·92. (Not official.)

SOURCE.—Obtained from sea water and saline springs.

CHARACTERS.—A darkish brown volatile liquid with a strong and disagreeable odour. *Solubility.*—1 in 30 of water.

IMPURITY.—Iodine and chlorine.

ACTION.

Like that of chlorine and iodine. It is rarely used in medicine.

1. Potassii Bromidum. Potassium Bromide. KBr.

SOURCE.—Obtained by the interaction of ferrous bromide with potassium carbonate.

CHARACTERS.—Colourless cubic crystals, readily so in water, with a saline taste.

INCOMPATIBLES.—Acids, acid salts, metallic salts, strychnine.

Dose, 5 to 30 gr. 3 to 20 decigrms.

2. Sodii Bromidum. Sodium Bromide. N

SOURCE.—Obtained in the same way as potas bromide, sodium carbonate being used in place of pota carbonate.

CHARACTERS.—A granular white powder in small crystals with a saline taste. *Solubility.* 1 in about 2 of w

INCOMPATIBLES. Those of potassium bromide.

Dose, 5 to 30 gr. 3 to 20 decigrms.

3. Ammonii Bromidum. Ammonium Bro NH_4Br.

SOURCE.—Made by neutralizing hydrobromic acid liquor ammoniæ and crystallizing.

CHARACTERS.—Small colourless cubic crystals wit pungent saline taste. *Solubility.*—1 in 1½ of water.

INCOMPATIBLES.—Acids, acid salts, strychnine, and s of nitrous ether.

IMPURITIES.—Iodides, free bromine.

Dose, 5 to 30 gr. 3 to 20 decigrms.

1. Strontii Bromidum. Strontium Bro $SrBr_2, 6H_2O$

SOURCE.—Neutralize dilute hydrobromic acid strontium carbonate.

CHARACTERS.—White acicular, deliquescent cryst Soluble in less than 1 part of water and in alcohol.

Dose.—5 to 30 gr. 3 to 20 decigrms.

ACTION OF BROMIDES.

External.—They have none.

Internal.—*Alimentary canal.* Solutions of a of these three bromides, frequently painted on throat, diminish its sensibility. Medicinal doses h no other effect on the alimentary canal. All bromi are quickly converted into **sodium bromide** in stomach and intestines, and they are readily absorb

Nervous system.—Bromides are powerful **depressants to the nervous system.** Thus, if an animal be large doses of any of them, irritation of the cortical motor areas, which before easily excited movements, fails to do so. Experiments also show that the reflex excitability of the cord is considerably diminished, and that the activity of the sensory mechanism is also impaired, for large doses of bromides given to frogs cause cutaneous **anæsthesia.** In at least, not only the cortical motor area but the as a whole is depressed; therefore these drugs powerful **hypnotics.** It is probable that in addition to the brain and spinal cord the peripheral nerves are depressed, so that bromides are well entitled to be called powerful nervous depressants. The irritability of the muscles is also diminished, not by the action of the drugs on the nervous endings, but by their direct action on them. It has definitely shown by H. K. Wright that excessive doses of bromide of potassium cause in both and rabbits degeneration of the cortical cells, that this degeneration begins at the periphery of dendrons.

Circulation.—Many sufferers from epilepsy take doses of bromides daily for years without any on the heart or circulation, hence the common statement that bromides in such doses are depressant incorrect. Toxic doses produce a fall of temperature; this is probably in some way secondary to the depression of the circulation.

Respiration is slightly depressed by bromides.

Metabolism.—The amount of carbonic acid exhaled is greatly decreased by taking large doses of bromides. The amount of urine is increased; the colouring matters, the sulphur, and the nitrogen in it are increased; but the phosphorus is decreased.

Sexual organs.—If bromides are taken for a long time, a failure of sexual vigour is produced, ultimately there is a great lessening of the se appetite. Bromides are therefore anaphrodisiac

Elimination. Bromides are rapidly elimin by the kidneys, skin, saliva, intestinal mucous m brane, bronchial mucous membrane, and milk.

Bromism.— If bromides are taken for too lo period, a series of symptoms of poisoning, to w the above name has been given, may appear. earliest of them is a rash, consisting of red pap chiefly on the face and back, exactly resem some forms of acne. This is probably the resu the excretion of the bromide by the skin. The symptoms are a general lowering of the cutan sensibility and also of that of the pharynx, there is diminution of sexual power, the pa becomes low-spirited, easily fatigued, unfit for w and his intellect is dulled, and in bad cases passes on to dementia, melancholia, and other m disorders. There may be a little conjunctivitis, some increased secretion from the bronchi.

Bromides owe their action to the bro in them. In man at least, the higher func of the brain are depressed before the lower, these again before the spinal. Thus the de sion takes place in regular order from above d wards, in the reverse order of the physiolo development of the functions, and this is comm the case with many drugs. (*See* Law of Dissolu p. 108.)

Those who take bromides habitually find t selves unable to sleep without them, and their i lect becomes obscured. These bad effects are tensified by the fact that gradually larger dose required to produce sleep, and thus the unfortu sufferer becomes more and more a slave to drug.

THERAPEUTICS OF BROMIDES.

External.—None.

Internal.—*Alimentary canal.*—Formerly the back of the throat was painted with a solution of a bromide before a laryngeal examination, but now cocaine is employed for this purpose.

Nervous system.—Because of their depressing effect bromides are largely used for many nervous diseases. They are the most valuable drugs we have for the treatment of epilepsy, acting no doubt by diminishing the excitability of the cerebral cortex. They rarely cure, but often greatly diminish the number of fits. It is impossible to say of any given case whether bromides will do good, therefore they must be tried in all; petit mal is more difficult to influence than grand mal. The next most common use of bromides is as hypnotics. They are most useful when there is no organic cause to explain the insomnia, and therefore they are not employed when pain keeps the patient awake, but are given with great benefit in the insomnia of overwork, worry, or that connected with the climacteric period. The sleep induced is quiet and refreshing, without dreams, and therefore these drugs are often of great value in nightmare, and in the night screaming of children, which may be regarded as allied to nightmare. Also because of their depressant effect on the nervous system they are given in migraine, and often they are the only drugs which do any good for the intense headache of this disease. Large doses, even a drachm at a time, are given in delirium tremens, especially in combination with chloral, and sometimes the patient seems quieter for this treatment. Not only the insomnia, but the other nervous symptoms that are common at the climacteric period may be relieved by bromides. For their depressing

power on centres below the cortex they are used,
with good results, in laryngismus stridulus, and
been given in whooping-cough, but the benefit is
marked. Some cases of tetanus have recovered
enormous doses of bromides. Here their value is
doubt, due to their power of diminishing the r
function of the spinal cord. Bromides have
given as antidotes for strychnine poisoning. S
times they succeed in cases of hysteria and neura
and some varieties of functional disease of the b
are much improved by them.

Sexual functions. Because of its depres
effect bromide of potassium is given for sperma
rhœa and nymphomania.

The bromides of potassium, sodium, ammoni
and strontium probably have, in the main, the s
action, but potassium bromide is usually preferred,
the others are only given when the potassium
produces considerable cardiac depression. Rubid
ammonium bromide (dose, 30 gr., 2 grms.) app
to be the best bromide for some cases of epile
Monobromated camphor (one hydrogen atom
camphor is replaced by bromine) is often efficac
(dose, 2 to 10 gr., 12 to 60 centigrms., in a caps

The Liquor Bromidi Compositus (B. P. C.), d
½ to 2 fl. dr. (2 to 8 mils) — one fl. dr. contains
gr. each of chloral hydrate and bromide of potassi
and, in addition, Indian hemp, hyoscyamus, ora
peel, and glycerin — is an imitation of the mixt
called Bromidia.

5. Acidum Hydrobromicum Dilutun

Diluted Hydrobromic Acid.

Source.—It is prepared by the interaction of potas
bromide with sulphurous acid.

Characters.—A colourless acid liquid. Sp. gr. 1
Contains 10 per cent. of hydrogen bromide, HBr.

Dose, 15 to 60 m.—1 to 4 mils.

ACTION AND THERAPEUTICS.

The action of this acid appears to be the same as that of the bromides of the alkaline metals, but it is very rarely used for the same purposes. It has been employed with occasional success to relieve noises in the ears, and it is said to prevent the symptoms of poisoning by quinine.

Brominol. *Synonym.* Bromipin. (Not official.) This combination of bromine with sesame oil contains [illegible] per cent. of bromine. The usual dose is 1 to 4 drachms (4 to 16 mils), and it may be given in an emulsion or in capsules. It is very popular with some prescribers and is used for the same conditions as other bromides, *e.g.*, epilepsy, sleeplessness and many functional nervous disorders. A 33 per cent. strength is prepared for rectal injection.

Bromural (not official) is monobrom-isovalerianyl-urea. An excellent hypnotic with no depressing after effects. The dose is 5 to 10 gr. (3 to 6 decigrms.). Usually it is sold in tablets.

GROUP X.

Containing **Sulphur** only.

SULPHUR.

Symbol, S. Atomic weight, 32·07.

Sulphur is official in two forms.

1. Sulphur Sublimatum. Sublimed Sulphur.

Synonym.—Flowers of sulphur.

SOURCE.—From crude sulphur or sulphides by sublimation.

CHARACTERS.—A greenish-yellow gritty powder.

IMPURITIES.—Sulphurous and sulphuric acids, sulphide of arsenic, earthy matters.

Dose, 20 to 60 gr. 12 to 40 decigrms.

Preparation.

Unguentum Sulphuris.—Sublimed sulphur, 1; benzoated lard, 9.

In India benzoated suet should be employed instead of benzoated lard.

Sublimed sulphur is contained in Pulvis Glycyrrhizæ Compositus.

2. Sulphur Præcipitatum.—Precipitated phur. *Synonym.*—Milk of sulphur.

Source.—Sulphur is precipitated by hydrochloric from a solution of calcium sulphides and thiosulphate, wh has been made by boiling together sulphur and lime in wa

Characters.—A greyish-yellow soft powder free fr grittiness.

Impurity.—Calcium sulphate, which makes it gritty

Dose, 20 to 60 gr. 12 to 40 decigrms.

Preparations.

1. Confectio Sulphuris.—Precipitated sulp 150; acid potassium tartrate, 110; tragacanth syrup, 210; tincture of orange, 55; glycerin, 170.

Dose, 60 to 120 gr. 4 to 8 grms.

2. Trochiscus Sulphuris.—Precipit. sulphur, 150; potassium acid tartrate, 30; sugar, 2 gum acacia, 30; tincture of orange, 30; mucilag gum acacia, 30. Each lozenge contains 0·3 grm 5 gr. of sulphur and 0·06 grm. or 1 gr. of potassium tartrate.

Action of Sulphur.

External.—Sulphur itself has no action on skin, but some of it is converted into sulphuret hydrogen, and that is a mild vascular stimula causing slight dilatation of the vessels and in so persons eczema. It kills the *Sarcoptes hominis*, a is therefore a **parasiticide**. When applied to r surfaces it is converted into sulphurous and sulphu acids, and is therefore a severe irritant.

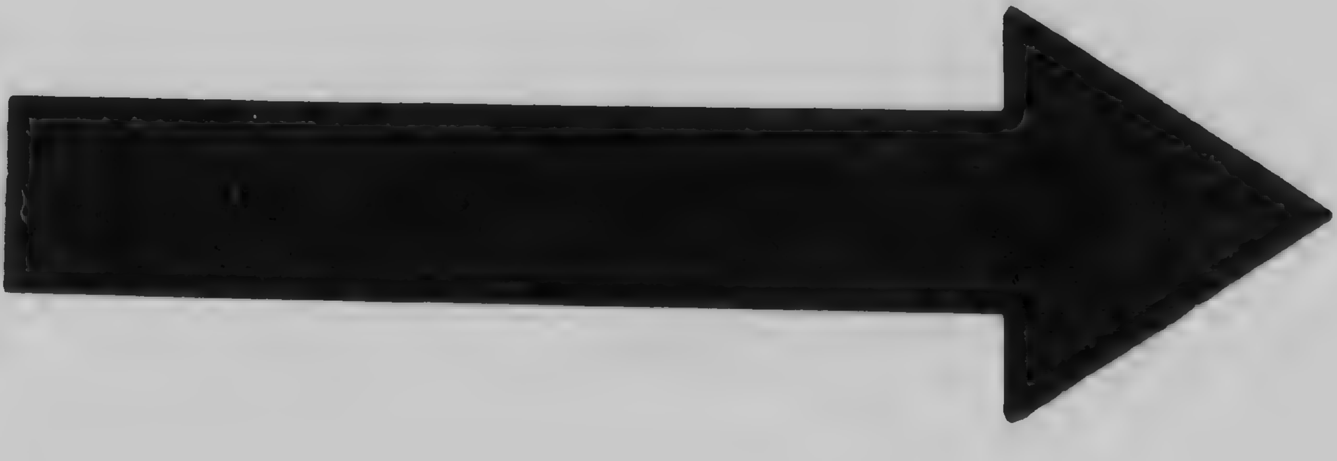
Internal.—*Alimentary canal.*—It has no eff on the stomach, and most that is taken is passed o in the fæces unaltered. A certain amount is, in t intestine, converted into sulphuretted hydrogen a other sulphides. These cause a **mild laxative** effe increasing the secretion of intestinal juice, a slightly stimulating the muscular coat, produci soft semi-liquid stools, sometimes accompanied flatus of sulphuretted hydrogen, which, if in suffici quantity, makes sulphur an undesirable laxative.

Remote effects.—Sulphur is absorbed as sulphides and sulphuretted hydrogen, which is a powerful poison, decomposing the blood and thus producing symptoms of asphyxia. It also paralyses the whole nervous and muscular systems, but sulphur is never given to man in sufficient doses to produce any remote effects. Patients taking sulphur get rid of some minute portion of it as sulphuretted hydrogen through the kidneys, the milk, the lungs, and skin, and some as sulphates in the urine. The breath occasionally smells of it, and silver ornaments next to the skin may be discoloured.

THERAPEUTICS OF SULPHUR.

External. - Sulphur is commonly used to kill the *Sarcoptes hominis*, and thus to cure scabies. The skin should be well scrubbed with soft soap and hot water to lay open the burrows. Then it is thoroughly rubbed with the ointment. The patient should do this before bedtime, sleep in flannel, and wash the ointment off the next morning. This proceeding repeated three or four times will generally cure the disease. Sulphur ointment was formerly applied as a stimulant to ulcers, and was rubbed in for chronic rheumatism, but these modes of treatment are now rarely used, and their value is doubtful. Mild sulphur preparations are applied for acne.

Internal. *Alimentary canal.*—Sulphur is a very good laxative, especially for children; as it produces a soft motion but no pain, it is useful for cases of piles or fissure of the anus. Sublimed sulphur is contained in compound liquorice powder, which is an excellent and popular laxative. One or two sulphur lozenges taken at bedtime often secure an easy evacuation of the bowels the next morning in persons liable to slight constipation. These lozenges have been recommended for constipation associated with



MICROCOPY RESOLUTION TEST CHART

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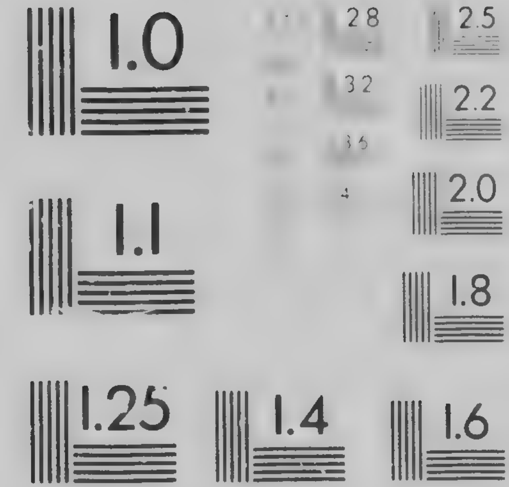

APPLIED IMAGE Inc

hepatic disease, and many mineral waters containing sulphides of sodium and hydrogen have considerable reputation for hepatic disorders. Of these, Harrogate water has been shown to increase the amount of bile and the solids in it.

Remote effects. Sulphur has been administered internally for all sorts of skin diseases, generally without any good result, but occasionally chronic eczema associated with much itching appears to be benefited by it, so that the sulphur lozenge is a suitable laxative for these cases. Sulphur has been also given for bronchitis, for chronic rheumatism, and rheumatic myalgia, but it is very doubtful whether in these diseases there is much relief from this treatment.

Potassa Sulphurata. Sulphurated Potash. *Synonym.* Liver of sulphur. A mixture of salts of which the chief are potassium sulphides.

Source. Heat in a crucible a mixture of sulphur and potassium carbonate.

Characters. Dull green solid masses, the freshly broken surfaces of which are liver-coloured.

Calx Sulphurata. Sulphurated Lime. A mixture containing not less than 50 per cent. of calcium sulphide with calcium sulphate and carbon.

Source. Heat calcium sulphate with wood charcoal.

Characters. A greyish white powder, smelling of sulphuretted hydrogen.

Dose, ¼ to 1 gr. 16 to 60 milligrms.

Action of Sulphurated Potash and Sulphurated Lime.

External. These preparations are irritant, and are powerful **parasiticides** for the *Sarcoptes hominis*.

Internal.—Nothing is known of their internal action.

THERAPEUTICS OF SULPHURATED POTASH AND SULPHURATED LIME.

External. -An ointment of either will cure scabies, and a sulphurated potash ointment (1 in 80) is often used for this purpose in the same way as sulphur ointment. Both drugs have been used for many chronic skin diseases, but now they are not often employed. They appear, however, occasionally to do good to cases of acne indurata. Baths containing sulphides in solution are considered by many to be very useful for chronic rheumatic arthritis and rheumatic myalgia. The famous natural sulphide baths are those of Aix-la-Chapelle, Aix-les-Bains, and there are many others, which will be found described in works on general therapeutics; but as in all of them the water is warm, and warm water is beneficial for chronic rheumatism, and the sulphides exist in infinitesimally small quantities, it is very probable that the benefit is due more to the heat of the water than to its constituents. An artificial bath (sulphurated potash 4 oz., water 30 gals.) is used for chronic psoriasis.

Internal.—Sulphides have been given for chronic rheumatism, various skin diseases, and phthisis, but the evidence of the good done is scanty. Calx Sulphurata has been especially recommended for boils, carbuncles, and tubercular glands in the neck. Half a grain or a grain should be given every four hours. It is best made into a pill with acacia, milk sugar, and syrup.

GROUP XI.

ACIDS.

Those acids which will be considered here may be divided into two classes.

Class I. Those which are strongly acid, the more powerfully acid being active caustics. They are **Sulphuric, Nitric, Hydrochloric, Nitro-hydrochloric, Phosphoric, Acetic, Tartaric, Citric, Lactic,** and **Formic** acids. **Hydrobromic** acid and **Hydriodic** acid might be placed here, but they have already been considered.

Class II.—Those which, although feebly acid, are antiseptic. They are **Sulphurous** and **Boric** acids.

Dilute hydrocyanic, carbolic, benzoic, oleic, tannic and salicylic acids are not used as acids, and will be considered under other headings.

Arsenious acid and chromic acid are not true acids; they are anhydrides, and have already been considered (*see* pp. 225 and 240). Oxalic acid is in the Appendix to the Pharmacopœia as a test.

CLASS I.

1. Acidum Sulphuricum.—Sulphuric Acid contains not less than 95 per cent. of hydrogen sulphate, H_2SO_4.

SOURCE.—Produced by the combustion of sulphur or pyrites, and the oxidation and hydration of the resulting sulphur dioxide by means of nitrous and aqueous vapours.

CHARACTERS.—A colourless liquid, of an oily consistency intensely acid and corrosive. Sp. gr. 1·841.

IMPURITIES.—Oxides of nitrogen, lead, arsenic.

INCOMPATIBLES.—Alkalies, their carbonates, lead, and calcium salts.

Preparations.

1. Acidum Sulphuricum Dilutum. Sulphuric acid, 112·5; distilled water, 940; sp. gr. 1·069 Contains 10 per cent. of hydrogen sulphate, H_2SO_4

Dose, 5 to 20 m.—3 to 6 decimils.

It is contained in Infusum Rosæ Acidum.

2. Acidum Sulphuricum Aromaticum.—*Synonym.*—Elixir of vitriol. Sulphuric acid, 70; spirit of cinnamon, 15; tincture of ginger, 250 alcohol (90 per cent.), to produce 1000. Sp. gr. 0·917 to 0·923. It contains much ethyl sulphuric (sulphovinic) acid.

Dose, 5 to 20 m.—3 to 12 decimils.

It is contained in Infusum Cinchonæ Acidum.

2. Acidum Nitricum. Nitric Acid contains 70 cent. of hydrogen nitrate, HNO_3, and 30 per cent. of ter.

SOURCE.—Made from sodium nitrate by distilling with phuric acid.

CHARACTERS.—A colourless, fuming, very acid liquid. Sp. gr. 1·42.

IMPURITIES.—Sulphuric acid, nitre, and lower oxides of gen, giving ruddy fumes.

INCOMPATIBLES.—Alcohol, alkalies, carbonates, oxides, n sulphate, lead acetate.

Preparations.

1. Acidum Nitricum Dilutum.—Nitric acid, 151; distilled water to produce 1000. Contains 10 per cent. of hydrogen nitrate, HNO_3.

This preparation is approximately three-fifths the strength of the corresponding preparation, B. P. 1898.

Dose, 5 to 20 m.—3 to 12 decimils.

2. Acidum Nitro-hydrochloricum Dilutum. Nitric acid, 3; hydrochloric acid, 4; distilled water, 25. Make fourteen days before use. Contains free chlorine, hydrochloric, nitrous, and nitric acids dissolved in water. The fumes given off consist of nitrosyl chloride. Sp. gr. 1·07.

Dose, 5 to 20 m.—3 to 12 decimils.

3. Acidum Hydrochloricum. Hydrochloric Acid.

SOURCE.—The fumes produced by the action of sulphuric acid on sodium chloride are dissolved in water.

CHARACTERS.—A colourless, very acid, fuming liquid. Sp. gr. 1·16. Contains 31·79 per cent. of hydrogen chloride, HCl, and 68·21 per cent. of water.

INCOMPATIBLES.—Lead and silver salts, alkalies and their carbonates.

Preparations.

1. Acidum Hydrochloricum Dilutum.—Hydrochloric acid, 33; distilled water to produce 100.

Dose, 5 to 20 m.—3 to 12 decimils.

2. Acidum Nitro-hydrochloricum Dilutum, *see* Nitric Acid.

4. Acidum Phosphoricum Concentratum. Concentrated Phosphoric Acid is a liquid containing 66·3 per cent. of hydrogen orthophosphate, H_3PO_4 and 33·7 per cent. of water.

SOURCE.—Obtained by the oxidation of phosphorus.

CHARACTERS.—A colourless syrupy liquid, of a sour taste. Sp. gr. 1·5.

INCOMPATIBLES.—Calcium preparations, sodium carbonate.

Preparation.

Acidum Phosphoricum Dilutum.—Concentrated phosphoric acid, 159·5; water to produce 1000. It contains 10 per cent. of hydrogen orthophosphate

Dose, 5 to 20 m.—3 to 12 decimils.

5. Acidum Aceticum.—Acetic Acid.

SOURCE.—Obtained from wood by destructive distillati and purification, or from ethylic alcohol by oxidation.

CHARACTERS.—A colourless liquid. Sp. gr. 1·044. Contains 33 per cent. of hydrogen acetate, $HC_2H_3O_2$ and 67 water.

IMPURITIES.—Lead and copper, sulphuric, hydrochlor and sulphurous acids.

Preparations.

1. Acidum Aceticum Dilutum.—Acetic acid diluted with distilled water until it has a sp. gr. 1·007, and contains 5 per cent. of hydrogen acetate.

Dose, ½ to 2 fl. dr. 2 to 4 mils.

2. Oxymel.—Acetic acid, 1; water, 1; purified honey, 5.

Dose, ½ to 2 fl. dr.—2 to 8 mils.

6. Acidum Aceticum Glaciale.—Glacial Acetic Acid.

CHARACTERS.—A colourless very acid liquid. Sp. gr. 1·058. Contains not less than 98·9 per cent. of hydrogen acetate, $HC_2H_3O_2$.

7. Acidum Citricum.—Citric Acid, Hydrogen Citrate.

SOURCE.—Obtained from the juice of the fruits of various species of Citrus, and contains not less than 99·5 per cent. of hydrogen citrate, $H_3C_6H_5O_7,H_2O$.

CHARACTERS.—Large colourless trimetric prisms, very soluble in water. **35 gr. to 1 fl. oz.** of water make a solution of the **same average strength as lemon juice,** and **neutralize 50 gr. of potassium bicarbonate, 42 gr. of sodium bicarbonate,** or **26 gr. of ammonium carbonate.** Citric acid, like tartaric acid, is often used to produce an effervescing mixture with one of the above carbonates, the two solutions being mixed immediately before use. The carbonic acid gas which causes the effervescence is formed thus:—$3KHCO_3 + H_3C_6H_5O_7 = K_3C_6H_5O_7 + 3CO_2 + H_2O$.

INCOMPATIBLES.—Potassium tartrate, alkaline carbonates, [illegible].

IMPURITIES.—Copper, lead, sulphuric and tartaric acids, mineral matters.

Free citric acid is contained in Succus Limonis, Syrupus Limonis.

Dose, 5 to 20 gr.—3 to 12 decigrms.

8. Acidum Tartaricum.—Tartaric Acid, or [illegible]-rotatory hydrogen tartrate. It contains not less than [illegible] per cent. of hydrogen tartrate, $H_2C_4H_4O_6$.

SOURCE.—Prepared from potassium acid tartrate.

CHARACTERS.—Colourless opaque monoclinic prisms, longer than those of citric acid. Very soluble in water. **35 gr. neutralize 46 gr. of potassium bicarbonate, 38 gr. of sodium bicarbonate,** or **24½ gr. of ammonium carbonate.**

INCOMPATIBLES.—Salts of potassium, calcium, mercury, and vegetable astringents.

IMPURITIES.—Lead, oxalic acid, lime, and potassium [illegible].

Tartaric acid is contained in Pilula Quininæ Sulphatis.

Dose, 5 to 20 gr.—3 to 12 decigrms.

9. Acidum Lacticum.—Lactic acid is an aqueous solution containing not less than 75 per cent. of hydrogen lactate, $HC_3H_5O_3$, and not less than 10 per cent. of lactide, $C_6H_8O_4$.

SOURCE.—It may be made by the fermentation of lactose.

CHARACTERS. A colourless syrupy liquid. Sp. gr. 1·21. Mixes well with water, alcohol, and ether.

IMPURITIES.—Mineral acids, sugar, lead, and iron.

Dose, 15 to 30 m. 1 to 2 mils.

Preparation.

Syrupus Calcii Lactophosphatis (see p. 163).

ACTION OF SULPHURIC, NITRIC, HYDROCHLORIC, PHOSPHORIC, ACETIC, CITRIC, TARTARIC, AND LACTIC ACIDS.

External. All these acids are powerful **irritants** when applied externally. The feeblest is citric. Its concentrated solution has no action on the sound skin, but is irritant to mucous membranes and abraded surfaces. Tartaric is stronger than citric acid; it will act upon the unabraded skin, and applied to a sore it produces pain, a sensation of burning, and considerable vascular dilatation. The remaining acids are very powerful irritants, therefore even weak dilute solutions of them may produce considerable redness and perhaps vesication, and when the solution is strong they are **very energetic caustics**; sulphuric and phosphoric acids, having a powerful affinity for water, are especially active. Sulphuric acid leaves the carbon untouched, therefore it blackens; nitric stains the skin a deep yellow owing to the formation of nitro-derivatives of tyrosine; it does not redissolve the albumen it precipitates, and it is consequently limited in its area of action; nitro-hydrochloric is very powerful; hydrochloric is the least active of the mineral acids; glacial acetic acid is useful when a limited action is required. All the stronger acids unite with and **coagulate albumen**; hence weak solutions, not strong enough to form a slough, which by its separation may cause bleeding, will, by coagulating the blood and so plugging the vessels, and by coagulating the albumen in the tissues and so constricting the vessels, act as **astringents** and **hæmostatics**. Dilute solutions of acids are cooling to the flushed skin of fever, therefore they are called **refrigerants**. Acids are general protoplasmic poisons, hence they kill many micro-organisms, are antiseptic, and locally applied to the heart depress it.

Internal. *Mouth.* All acids have a peculiar taste, and give rise to a feeling of roughness about the teeth. With regard to the saliva they **increase the amount secreted**, consequently by keeping the mouth moist they allay thirst.

Stomach.—Nitric acid interferes with digestion of proteins, as it combines with them. When the amount of acid secreted by the gastric mucous membrane is deficient, acids taken after a meal, when all that the stomach can secrete has been secreted, aid digestion, hydrochloric being the best.

Pancreas.—Acids experimentally placed in, or passed from the stomach into, the duodenum convert the prosecretin existing in the duodenal mucous membrane into secretin, and, this being absorbed into the blood, excites the pancreatic flow.

Intestine.—Acids quickly become converted into neutral salts, and are probably absorbed as such. Some, especially sulphuric (diluted), are said to preserve in the intestine their astringent action. They have been said to increase the amount of bile poured into the intestine, especially in the case of nitric acid and nitro-hydrochloric acid. The presence of acids in the duodenum leads to reflex closure of the pylorus; hence when sufficient of the gastric contents have passed into the duodenum, the pylorus closes, and relaxes as soon as the duodenal contents are neutralized and passed on. Lactic acid is believed to be an excellent intestinal disinfectant, especially of the large bowel.

Remote effects.—Acids increase the acidity of the blood to only a slight extent. The mineral acids are neutralised by combining with the bases of the blood and tissues, thus displacing carbonic acid, so that the blood contains less carbonic acid. In man and the carnivora these acids are also neutralised by ammonia. They are excreted in the urine, neutralised partly by bases, partly by ammonia, so that the ammonia nitrogen ratio rises, but the acidity of the urine is only slightly increased. As high alkalinity of plasma and tissues favours metabolism, acids slightly diminish it. Phosphoric acid is believed to increase the amount of phosphates in the red blood-corpuscles. The administration of hydrochloric acid will increase the number of red corpuscles in chlorosis, but it does not alter the amount of hæmoglobin. Nitric acid is stated to be excreted to a small extent as ammonia, and hence slightly to increase the alkalinity of the urine. Acetic, citric, lactic, and tartaric acids are mainly oxidised in the body to carbonic acid. This has already been discussed (*see* p. 135). Alkaline citrates inhibit the coagulation of blood. Large doses of mineral acids increase respiration and produce a comatose condition in herbivora by increasing the acidity of the blood. In carnivora this result is very difficult to obtain owing to the neutralisation of the acid by ammonia.

THERAPEUTICS OF SULPHURIC, NITRIC, HYDROCHLORIC, PHOSPHORIC, ACETIC, CITRIC, TARTARIC, AND LACTIC ACIDS.

External.—Nitric acid is more often used as a caustic than the others, for, owing to their great affinity for water, it is difficult to limit the action of sulphuric and phosphoric acids; and the remaining acids are not so powerful as nitric acid. It is employed to destroy warts, condylomata, unhealthy phagedænic sores, cancrum oris, &c. Glacial acetic acid is used for small warts and corns. If this causes pain it may be diluted. Very diluted solutions are rarely employed for their irritant effects; in some bathing establishments acid baths are used, but it is not proved that they do any good. Any well-diluted acid, especially sulphuric, may be applied to check slight bleeding, as that of leech-bites, piles, &c. Vinegar can always be obtained; even it should be diluted. In fever the skin is often bathed with vinegar as a refrigerant, and very dilute sulphuric acid is used as a local astringent in the sweating of phthisis.

Internal.—*Mouth.*—As acids damage the teeth they should be taken through a glass tube. Lemon juice or citric acid itself is often used to stimulate the secretion of saliva, and hence allay the thirst of fever patients. Lemonade is a favourite drink for this purpose. Lactic acid has been strongly recommended to dissolve off the membrane in diphtheria, but there is no evidence that this treatment benefits the patient. Equal parts of lactic acid and water may be applied with a mop, or a spray of a strength of 1 fl. dr. to 1 fl. oz. of water may be employed. Very dilute nitric acid has been used for the same purpose. Lactic acid may be applied with a brush in tuberculosis of the larynx, and in some cases with good results. It is usual to begin with lactic acid 50 per cent., water 25 per cent., and glycerin 25 per cent. The strength of the solution is increased till at last the acid alone is used. Other accessible tuberculous ulcers—as those of the tongue and skin—may be treated in the same way.

Stomach and Intestines.—Hydrochloric and to a less extent nitro-hydrochloric acids are of the greatest value to that variety of dyspepsia in which the acidity of the gastric juice is deficient. They should, as already explained, be given some little while after a meal. A very usual stomachic mixture consists of dilute nitro-hydrochloric acid combined with tincture of nux vomica and some other stomachic, as compound tincture of gentian. Lactic acid has been used for the same purpose. Acids will often alleviate that form of indigestion in which the patient complains of acid eructations and heartburn. For this purpose they should be given during a meal or before it. They then check the excessive secretion of acid and restrain fermentation. An acid mixture sometimes benefits the indigestion of pregnancy, and small doses of hydrochloric acid may be prescribed during typhoid and other fevers, because the secretion of this acid is much diminished when the temperature is raised. Vinegar is sometimes drunk to reduce obesity, but it only does so because a long course of any acid will set up a mild gastritis, and thus hinder the digestion and absorption of food. Carbonic acid, taken in an effervescing mixture, is a common and very efficacious gastric sedative, beneficial therefore in painful dyspepsia and in vomiting. Dilute sulphuric acid may be used as a hæmostatic in bleeding from the stomach or intestines, but its action is feeble. It is, however, successful as an astringent in many cases of summer diarrhœa. Nitric and nitro-hydrochloric acids, increasing the amount of bile poured into the intestine, are given, and sometimes with much benefit, when it is considered that dyspepsia is due to disordered function of the liver. Dilute sulphuric acid is often taken by workers in lead factories, as it forms an insoluble sulphate of lead in the intestines, and so prevents absorption of lead.

Soured milk is occasionally of benefit in many intestinal diseases, *e.g.* summer diarrhœa and colitis. Several powders, *e.g.* lacto-bacilline, and liquids are in the market, each said to contain a mixture of lactic acid bacilli; of these the Eastern varieties, *e.g.* the Bulgarian bacillus, are the most valuable. Previously sterilised milk is sown with a suitable powder or liquid and maintained at a certain temperature for a certain time until it is curdled and not too bitter for taste. It may then be drunk like ordinary milk—two or three pints a day for an adult—and the still active lactic acid bacilli in it inhibit the growth of intestinal micro organisms and the lactic acid formed from the lactose in the milk acts as an intestinal disinfectant. The temperature and duration of the preparation of the milk vary with the apparatus used and the temperature of the external air. This milk is especially useful for diseases of the large bowel.

Remote effects.—The remote effects of salts of citric, tartaric, and acetic acids have already been described (p. 135). They are due to the increase in the alkalinity of the blood and the urine. Phosphoric acid is often given to weak, sickly, anæmic children with the view of improving the quality of the red blood-corpuscles, and possibly aiding the growth of bones, but it has not been proved to have any great value. The same may be said of the vegetable acids when employed for scurvy, and of lactic and phosphoric acids when given for diabetes; indeed, the latter are said to do harm. Lime juice was formerly a popular remedy for acute rheumatism, but it did little if any good. Sulphuric acid is by some said to be anhidrotic in the night sweating of phthisis, and had some reputation as a remote hæmostatic, but it is rarely given now for these purposes. Aromatic sulphuric acid, with a little syrup and water, forms a pleasant cooling drink in fever. Rohrig found that acids diminished the tracheal secretion, and some physicians find that they diminish the secretions in bronchitis. Alkaline citrates, diminishing the coagulability of the blood outside the body, have been given for thrombosis, but it is probably impossible to give enough to produce any appreciable result. We thus see that the remote effects of all acids, except citric, tartaric, and acetic, are unimportant.

10. Formic Acid.—(Not official.) *Synonym.* Aminic Acid, CH_2O_2. A colourless pungent caustic liquid.

Dose, 2 to 10 m.—12 to 60 centimils.—diluted with water. Given hypodermically **2-5 m.—12 to 30 centimils** (1 in 1,000 solution).

This acid is believed to increase the tone of muscles and so has been given in general weakness such as that which follows influenza and for fatigue of the ocular muscles. It is usually given as sodium formate (**Dose, 10 to 45 gr., 6 to 30 decigrms.**). It may be flavoured with syrup and vanilla. Elixir Formatum (B. P. C.), **Dose, 1 to 2 fl. dr., 4 to 8 mils,** is a good preparation. The Syrupus Glycerophosphatum cum Formatibus B. P. C. (**Dose, 1 to 2 fl. dr. 4 to 8 mils**) is a good preparation as a general tonic.

Toxicology of Acids.

All these acids are severe gastro-intestinal irritants when given in toxic doses. Tartaric, citric, and lactic are very rarely taken as poisons. The symptoms produced by the whole class are severe burning pain extending from the mouth to the stomach, excoriation of the mouth with the formation of sloughs, great difficulty in swallowing, vomiting of dark brown coffee-coloured material and shreds of mucus, intense abdominal pain aggravated by the slightest movement, generally obstinate constipation, but if the bowels are open the motions are dark, from the blood contained in them. Some of the acid generally passes down to the larynx and causes swelling of that organ, and consequently dyspnœa from obstruction to respiration. The patient becomes cold, collapsed, and covered with a cold sweat; his pulse is very feeble, and he suffers from great thirst. *Post mortem.*—The mucous membrane of the mouth and gullet is softened and corroded, and whitish grey sloughs and hæmorrhages may be seen here and there. The coats of the stomach are softened. It is often contracted, and it may be perforated, the aperture being irregular. If the acid escapes into the peritoneal cavity, it may act on almost any of the abdominal organs. Should the patient have lived long enough, there may be corrosion inflammation of parts of the small intestine. The mucous rane of the throat and larynx is inflamed and swollen.

Treatment. - Alkalies should be given at once, *e.g.* soap water, lime water, magnesia, washing soda; and then lcents, as milk, white of egg, oil, linseed tea. Do not the stomach-tube if sulphuric acid has been taken, other- ently wash out the stomach. Morphine may be injected taneously for the pain, and brandy subcutaneously for llapse.

CLASS II.

1. Acidum Sulphurosum.—Sulphurous Acid.

SOURCE.—An aqueous solution containing 6·4 per cent. of gen sulphite H_2SO_3 corresponding to 5 per cent. by of sulphur dioxide, SO_2. The sulphur dioxide may be ned by heating sulphuric acid with charcoal or sulphur.

CHARACTERS.—A colourless liquid with a sulphurous Sp. gr. 1·025.

IMPURITIES.—Sulphuric acid, mineral matters.

Dose, ½ to 1 fl. dr.—2 to 4 mils. Best given in Mistura ygdalæ.

ACTION.

External.—Sulphurous acid is strongly deoxidiz- and as it takes up oxygen so easily from organic tes, it readily decomposes them, becoming itself verted into sulphuric acid, and hence is irritant, not violently so, for the amount of sulphuric acid proportion to the water is slight. It is a **disinfectant and deodorant**, for, in virtue of its property sorbing oxygen, it destroys micro-organisms and sts fermentation. When applied to the skin it is a **parasiticide.**

Internal. It is believed to act as a disinfectant the stomach and intestines, but it is very doubtful ther enough of it to have any appreciable action this direction can be safely taken.

THERAPEUTICS.

External.—Sulphurous acid is chiefly used as an septic, disinfectant, and deodorant. Sulphurous anhydride is employed as a disinfectant for a sick room after a patient with an infectious disease has been in it. The chimneys and windows should be stopped up. A quarter to half a pound or more of flowers of sulphur is placed in an earthenware vessel and lighted. The door is shut, and the cracks around it pasted over. The room should be left untouched for six hours. Generally not enough sulphur is burnt for this method to be efficacious. Sulphurous acid (2 fl. dr. to 1 fl. oz., 8 to 30 mil of water) is locally applied to cure ringworm. Foul sores may be washed with it.

Internal.—Sulphurous acid is sometimes given internally with the object of preventing abnormal fermentation in the stomach and intestines in certain varieties of dyspepsia, but there is no clinical proof that it can do this, and it should be remembered that it is possible it may do harm by impeding the action of the normal ferments.

2. Acidum Boricum. Boric Acid. *Synonym.* Boracic acid, Hydrogen borate.

Source.—Obtained by the action of sulphuric acid on borax. Contains not less than 99·5 per cent. of orthoboric acid, H_3BO_3.

Characters. Colourless, pearly, lamellar crystals, feebly acid. *Solubility.* 1 in 25 of cold water; 1 in 3 of boiling water; 1 in 4 of glycerin; 1 in 30 of alcohol (90 per cent.). The solubility of boric acid is greatly increased by the addition of borax.

Incompatible. With sodium salicylate in powder a bor salicylate is formed.

Dose, 5 to 15 gr.—3 to 10 decigrms.

Preparations.

1. Glycerinum Acidi Borici.—Boric acid, 3; glycerin, 10. This is an imitation of Boroglyceride (see p. 281).

2. Unguentum Acidi Borici. Boric acid, finely powdered, 1; white paraffin ointment, 9.

3. Borax Purificatus. Borax, Sodium Pyroborate. Synonym. Sodium biborate. $Na_2B_4O_7.10H_2O$.

SOURCE. Neutralize boric acid with sodium carbonate, l native calcium borate with a solution of sodium carbonate. Also found native.

CHARACTERS. Transparent colourless crystals, alkaline, with a sweetish taste. *Solubility.* 1 in 25 of cold water; 1 in 1 of glycerin; not in alcohol.

Dose, 5 to 15 gr.—3 to 10 decigrms.

Preparations.

1. Glycerinum Boracis.—Purified borax, 1; glycerin, 6. Sodium metaborate, glyceryl borate, and boric acid are formed.

2. Mel Boracis. Purified borax, 10; glycerin, 5; purified honey, 85. A similar decomposition takes place here.

ACTION OF BORIC ACID AND BORAX.

External. Both boric acid and borax destroy micro-organisms, and are thus **disinfectant and antiseptic,** but their value is slight, and they are much more active in preventing than in inhibiting decomposition. The effect is extremely local. Solutions of boric acid will relieve itching. Neither substance produces any irritation. Boric acid is very largely used to preserve milk, butter, and animal food.

Internal.—Borax and boric acid check the action of saliva on starch, but, if anything, they increase the action of the gastric juice and the pancreatic secretion. Large amounts, however, slightly retard digestion, still larger are gastro-intestinal irritants. Boric acid is rapidly eliminated in the urine; it is said to increase the urea and the quantity of urine. It is also excreted in the saliva, sweat, and faeces, and it is stated in rare cases to cause abortion. It may cause a scaly eruption. In exceptional instances, when large quantities have been applied to raw surfaces or mucous membranes, rise of temperature, depression spirits, feeble pulse, ecchymoses, lumbar pain, albuminuria, and nausea, vomiting, and diarrhœa have supervened. Harmful symptoms do not follow from taking food preserved with boric acid if the amount of it is small, such as anything under 0·1 per cent. in milk, or 8 grains to the pint, but they may follow if large amounts are used; but its employment is undesirable, as the prolonged use of food preserved with boric acid may lessen the weight of the body. It should never be used for solid foods. It has been shown that borax and boric acid given in daily moderate doses to children do not obviously adversely affect metabolism, nor do they restrain intestinal putrefaction, but larger doses diminish nitrogenous metabolism.

THERAPEUTICS OF BORIC ACID AND BORAX.

As they do not irritate, both these substances are largely used to keep wounds, ulcers, and sores sweet. The action is so local that they cannot be used to dress cavities. Boracic lint is much employed to dress wounds. It is made by passing lint through a hot saturated solution of boric acid. Boracic cotton wool is made the same way; both are tinted pink. Lister's boric acid ointment consists of boric acid 1 part, white wax 1 part, paraffin 2 parts, almond oil 2 parts. A saturated solution of boric acid (4 per cent.), or a watery solution of 1 in 40 of the patented preparation boro glyceride (*see* p. 281), may be employed as an antiseptic wash. Such solutions are used for ozæna, vaginitis, urethritis, fetid perspiration of the feet, and ophthalmia. Colitis is occasionally benefited by washing out the large bowel with a couple of pints of a saturated solution of boric acid; sometimes tannic acid is added. Lister's ointment, or an ointment of boro-glyceride, may be used for pruritus, sunburn, &c. Powdered boric acid blown into the ear is very useful in fetid discharges from it. Thompson's fluid (borax, 1 oz., 32 grms.; glycerin, 2 fl. oz., 60 mils; water, 2 fl. oz., 60 mils), in the proportion of ½ fl. oz., 15 mils, to 4 fl. oz., 120 mils, of warm water, is commonly employed to wash out the bladder in cystitis. The glycerin and the honey of borax are excellent applications for aphthous states of the mouth, especially in children. The following is a good wash for the mouth: Glycerin of borax, 1 fl. dr., 4 mils; tincture of myrrh, 10 ♏, 6 decimils; water to 1 fl. oz., 30 mils. Listerine, used as a lotion or mouth wash, contains many ingredients, of which the chief is boric acid.

Borax has been given in epilepsy, and its use is losing ground. It is often prescribed with advantage in combination with bromides, but it is decidedly inferior to them, although in exceptional cases it may succeed when they have failed. As it is an antiseptic it has been given internally in typhoid fever and phthisis, but with doubtful benefit. Taken internally it is said to relieve irritability of the bladder. In rare cases its use has caused either psoriasis, a papular eruption especially marked near the elbows, an erythematous rash, or eczema. Nausea, loss of appetite, vomiting, and diarrhœa may be produced. It has no effect on the intelligence. The taste is best covered with syrup of orange peel. Boric acid given internally is a useful urinary antiseptic, especially if the urine is alkaline.

Boro-glyceride.—(Not official.)
SOURCE.—Heat 92 parts of glycerin with 62 of boric acid.
CHARACTERS.—A tough deliquescent mass, readily soluble water and alcohol.

It is a powerful antiseptic, and has been used as a dressing for wounds (*see* p. 280). The pharmacopœial imita of it is Glycerinum Acidi Borici (*see* p. 278).

GROUP XII.

CARBON AND ITS COMPOUNDS.

CLASS I.—**Carbon.**

CARBO.

Carbon. Symbol, C. Atomic weight, 12.

Carbon is only official as

Carbo Ligni.—Wood Charcoal.

SOURCE.—Wood charred by exposure to red heat with
access of air.

CHARACTERS.—A black powder without odour or taste.

ACTION.

External.—Dry charcoal absorbs gases and condenses them within its pores. It thus absorbs oxygen, and hence has an oxidizing power, parting with the absorbed oxygen to oxidize organic and other substances. Organic matter is believed to be decomposed by aerobic micro-organisms which act by oxidation, and anaerobic which decompose directly, producing offensively smelling and toxic bodies. Wild suggests that the reason for the **deodorant** action of charcoal is that it converts anaerobic into aerobic decomposition. It attracts and oxidizes colouring matters, and consequently decolorizes them. It has no effect on living organisms, and is not antiseptic.

Internal. Formerly it was thought only to oxidize when dry, but to a less degree it has this power when moist, presumably because there is still some active oxygen in its interstices. It is passed in the fæces unchanged.

THERAPEUTICS.

External.—Charcoal has been recommended as a deodorant for foul ulcers, but it is a dirty preparation, and large quantities must be used. Charcoal is used in pharmacy as a decolorizing agent.

Internal.—It has been given as a powder, as lozenges, and as biscuits, with the object of preventing fermentation in the stomach, but it is not of much use. Garrod has shown that a tablespoonful or larger doses of charcoal frequently repeated are antidotes against most active vegetable poisons, as opium, nux vomica, and aconite, for charcoal seems to have a special attraction for alkaloids. Animal charcoal is the best form to give as an antidote. Charcoal is used as a tooth powder.

II.—Ethylic Alcohol, Chloroform, Bromoform, Ether, Acetic Ether, Acetone, Æthyl Chloride, Methyl Chloride, and Æthyl Bromide.

All these substances produce local anæsthesia by evaporation. They are rubefacient if their vapour is confined. The stomach, heart, and central nervous system are first stimulated and then depressed by them. Nitrous oxide is considered with them for convenience.

ALCOHOL ETHYLICUM.

Ethylic Alcohol. Ethyl hydroxide. $C_2H_5.OH$.
Ethyl hydroxide is official in the eight following forms:

1. Alcohol Absolutum. Absolute alcohol (strictly this is an incorrect name, for it may contain 1 per cent. by weight of water). Often called "alcohol."

SOURCE.—Obtained by the dehydration of less strong ethylic alcohol and subsequent distillation.

CHARACTERS.—A colourless, very volatile and hygroscopic liquid free from odour. Sp. gr. 0·794 to 0·7969. Contains not less than **99** per cent. *by weight* of **alcohol**, and not more than **1** per cent. **water**.

2. Spiritus Rectificatus.—Rectified Spirit **Ethyl Hydroxide, 90** per cent. *by volume*; **Water, 10** p cent.

Source.—Obtained by distillation of fermented sacchari liquids.

Characters and Tests.—Colourless, transparent, inf mable liquid with a burning taste. Sp. gr. 0·8337. No r when evaporated. Clear when mixed with water (absenc oils and resins). No unpleasant smell when evaporated f filter paper (absence of fusel oil and allied bodies); and must respond to other tests given in the Pharmacopœia.

Alcohol (90 per cent.) is only slightly stronger t rectified spirit, B. P. 1885, containing 1·35 per cent. alcohol. On mixing alcohol and water, contraction of v and rise of temperature occur. When such a mixtur prescribed, the cooled liquid should be employed.

The four official liquids obtained by diluting alc (90 per cent.) with distilled water are:

3. Alcohol (70 per cent. *by volume*) 1000 litres alcohol (90 per cent.) + 310·5 millilitres distilled wat Sp. gr. 0·8899.

4. Alcohol (60 per cent. *by volume*) = 1000 litres alcohol (90 per cent.) + 556·5 millilitres distilled wat Sp. gr. 0·9134.

5. Alcohol (45 per cent. *by volume*) = 1000 litres alcohol (90 per cent.) + 1053·4 millilitres distilled water Sp. gr. 0·9435.

6. Alcohol (20 per cent. *by volume*) = 1000 litres alcohol (90 per cent.) + 3558·0 millilitres distilled water Sp. gr. 0·9760.

7. Vinum Xericum.—Sherry.

Characters.—A Spanish wine. Pale yellowish-brow colour. Contains not less than **16** per cent. *by volume* **ethylic alcohol,** with oils, colouring matters, &c., and wat Used to make all Vina except the two made with orange wine

8. Vinum Aurantii.—Orange Wine.

Source.—Made by fermentation of a saccharine soluti to which the fresh peel of bitter orange is added.

Characters.—Contains from **15** to **17** per cent. *by volume* of **ethylic alcohol.** Used to make Vinum Ferri Citrat and Vinum Quininæ.

Amount of Ethylic Alcohol by Volume in various important Substances.

Alcohol Absolutum	contains	99	per cent.
Alcohol (U.S.P.)	..	94	..
Spiritus Rectificatus		90	
Alcohol Dilutum (U.S.P.)		64·5	
Whisky		51 to 59	
Rum, Gin, Strong Liqueurs		51 to 59	
Spiritus Tenuior (Proof Spirit)*		57·09	
Spiritus Vini Gallici	..	43 to 57	
Port	..	20 to 30	
Vinum Album Fortius (U.S.P.)		23 to 29	
Sherry and Madeira	..	16 to 22	
Vinum Album (U.S.P.)	..	12 to 14	
Champagne	..	10 to 13	
Vinum Aurantii	..	10 to 12	
Burgundy	..	9 to 12	
Hock	..	9 to 12	
Claret	..	8 to 12	
Cider	..	5 to 9	..
Strong Ale or Stout	..	5 to 9	
Beer and Porter		2 to 5	..
Koumiss		1 to 3	..

ACTION.

External.—Alcohol is an antiseptic, preventing the formation of and killing putrefactive bacteria. If applied to the skin, alcohol quickly evaporates. It therefore cools the skin, which consequently becomes pale from the contraction of the small vessels; owing to this less sweat is secreted. Alcohol is thus refrigerant, astringent, and anhidrotic. But if

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[*] Proof Spirit is defined by Act of Parliament as "being such as shall, at a temperature of 51° F., weigh exactly $\frac{12}{13}$ parts of an equal measure of distilled water." Weaker spirits are called "under proof," and stronger spirits "over proof." Thus 25 degrees over proof means a mixture of alcohol and water in such proportion that 100 volumes of this mixture, when diluted with water to make the mixture proof spirit, yields 125 volumes of proof spirit; and 25 degrees under proof means a mixture of proof spirit and water containing in 100 volumes 75 of proof spirit and 25 of water.

evaporation is prevented in any way such as by a watch-glass or a piece of gutta percha or the alcohol is rubbed in, it quickly absorbs water from the skin and thus hardens it. Having passed through the epidermis it dilates the vessels, causes a feeling of warmth, and produces a **rubefacient** effect. It has the power of coagulating albumen, but the coagulum quickly redissolves. It extracts water from all tissues

Internal.—*Mouth.*—When concentrated, alcohol produces a feeling of warmth, or often even a **burning sensation**, in the mouth. If held there for some time the albumen of the superficial tissues is coagulated, and the mucous membrane becomes white, congested, and opaque, but this appearance soon disappears, as the coagulum is redissolved by the fluids of the tissues. Directly the alcohol is put into the mouth there is an increased flow of saliva, and the pulse may be quickened; these results are reflex, for they occur before there is time for the alcohol to be absorbed, but after absorption small amounts stimulate, large amounts depress the secretion of saliva. Alcohol has a slight local anæsthetic effect.

Stomach.—Here also, if the alcohol is sufficiently concentrated, there is a sensation of warmth or even of burning. If only small quantities are given, the gastric vessels dilate, the mucous membrane becomes red, and there is an increased secretion of gastric juice. All this can be seen to happen in cases of gastric fistula. The result of these effects is that the appetite is sharpened, and this explains the custom common with many people of taking a little alcohol immediately before meals, and also the common experience that alcohol taken during meals aids digestion. It also markedly increases the activity of the gastric movements and promotes absorption. Thus there are several ways in which **moderate doses of alcohol may help the digestive process**, and Bin has actually demonstrated, by removing the gastric tents at stated times after a meal, that alcohol digestion, and by giving potassium iodide he wed that it increased the rapidity of absorption. n small doses its effect on the ferments is unim- ant. In some cases it produces **local anæsthesia** in stomach, and so it may relieve gastric pain. It is slight extent decomposed into aldehyde and acetic l, and consequently some of the pepsin, peptones, l proteids are precipitated. This hinders digestion, usually not sufficiently to outdo the aid due to vascular dilatation, the increased secretion, and greater movement. The effect of **large doses very harmful.** The activity of the gastric juice estroyed, the gastric walls are inflamed, large ntities of mucus are poured out, and if the over- lgence is continued chronic gastritis ensues, the ric glands atrophy, and consequently we get the manent dyspepsia of drunkards.

A single dose of alcohol introduced into the mach in a concentrated form, *e.g.* neat brandy, ediately produces **important reflex effects.** The t beats more rapidly and more forcibly, the els of the whole body dilate, especially those of the ; hence there is a feeling of warmth. The blood- sure rises. These reflex effects are well seen in immediate restoration of a fainting person by the stion of a single dose of brandy. Dilute alcohol, beer, does not produce them. They are quickly wed by the effects of alcohol upon the circulation to its presence in the blood after absorption.

testines.—Here alcohol has a slight **astringent** t, and consequently it may check diarrhœa. It on the pancreatic as on the salivary secretion.

Blood. Alcohol is absorbed quickly and more ely by the blood vessels than the lacteals. It is l to increase and then diminish the amœboid vements of the white blood-corpuscles.

Temperature.—Alcohol is **antipyretic,** lowering the temperature in fever, and with large doses in health. This is chiefly due to cutaneous vascular dilatation and rapidity of circulation, but also slightly perhaps to general diminished oxidation.

Metabolism.—A litre of Rhine wine of average strength produces by its oxidation as much heat as five or six table-spoonfuls of olive oil, and an ounce of brandy yields 100 calories of energy. Neither the intake of oxygen nor the output of carbonic acid gas is altered by alcohol, therefore as it has been oxidized in the body **it saves the tissues and is a food.** Repeated observations have shown the proof of this, for although moderate doses of alcohol by their toxic action at first increase protein metabolism, yet in a few days they diminish the output of urea and uric acid 6 or 7 per cent., and by their oxidation protein tissues are spared; and that it is a food is also proved by the fact that the weight of the body may be maintained if a large amount of alcohol is taken, even if the rest of the food is very small in amount. It will be noticed that it is a food which can be absorbed without any previous digestion.

The diminished oxidation of tissues being much more marked in fatty than in protein tissues, may, in habitual drinkers of large quantities of alcohol, lead to an imperfect combustion of fat, consequently it accumulates in the tissues, and **obesity**, which is often increased by the amount of saccharine matters that alcoholic liquids contain, results. The skin acquires a velvety feeling.

With moderate doses, very little alcohol leaves the body in the urine, as it has been oxidized; with large doses the case is different.

Circulation.—The effects upon the circulation reflexly produced by stimulation of the mouth and stomach have already been mentioned. After alcohol is absorbed it influences the heart markedly. **It beats more powerfully and more rapidly,** the becomes fuller; these results are due to the pheral arterial dilatation and to a stimulating on the heart. The vaso motor system is acted all the **vessels of the skin dilate**; therefore, if reviously felt cold, the person who has taken the nol feels warm. The **blood-pressure rises** slightly, increased action of the heart more than compen ng for the vascular dilatation. The direct effects lcohol on the circulation after absorption appear slowly and last longer, but they are clearly lar to those due to the reflex stimulus from the ach, and therefore they continue them. The t of the increased circulation through the various ns is that they work to greater advantage; hence ntal faculties are brightened for a time, the ular strength seems increased, more urine is d, and the skin perspires. The person who has the alcohol, in fact, usually feels generally better t. This is by no means always so; some persons a headache or feel very sleepy immediately after ol. This is probably because the vessels of domen or skin have dilated so excessively that t all the blood in the body is in them, and consently there is very little in the brain. There are y individual peculiarities in the effects of alcohol.

It has been repeatedly proved that these good lts are but transitory. The **heart**, although at stimulated, is **more exhausted after the stimulation** has passed off than it was before. This is also of all the organs of the body stimulated by increased circulation induced by alcohol. In campaigns and Arctic expeditions it has been d that although at first the men, after taking ol, could do more work, yet soon they felt so and exhausted, that on the whole they could do n more without than with the alcohol. **Large** doses of alcohol do not stimulate the heart at all; **paralyse** it, both reflexly from the stomach and

after absorption. Enormous doses poured into th stomach kill almost immediately by reflex actio A drunkard who is "dead drunk" is, accuratel speaking, one who is killed by the paralysing ef of alcohol on the heart, but the phrase is ofte applied to any one who is very drunk.

Respiration.—The rapidity of respiration and th amount of air breathed are slightly increased b ordinary doses of alcohol. Whether this is due t stimulation of the respiratory centre is doubtf Very large doses depress it.

Skin.—Alcohol is **a mild diaphoretic,** part because of its vaso-dilator action, and perhaps al because of some direct influence on the sweat-glan As just mentioned, the cutaneous vascular dilatat leads to a feeling of warmth if the patient's cutaneou vessels were previously contracted from cold. It ma be that part of the **antipyretic** power of alcohol due to increased radiation from the dilated ves and also to evaporation of the increased amount sweat. If a person is in a cold atmosphere, alcohol by increasing the radiation from the skin, leads t the loss of so much heat that he may die from cold although at first the increased cutaneous circulation, making him feel warmer, gives him a del feeling of warmth.

Kidneys.—About 2 per cent. of the alcohol ingested—unless very large quantities are taken i excreted unchanged, mostly in the urine, to a le extent in the expired air, only the merest trace sweat, and none in the milk or fæces. Most of it oxidized in the body. It acts as a mild **diuretic** this is chiefly a secondary result of its vascular effec but it probably also acts directly on the glomer

Nervous system.—Unless the dose be very large th whole nervous system is **stimulated,** partly direct but also as a secondary result of cardiac stimulation. The highest functions are most affected. Th person who has taken the alcohol talks more fluently and brilliantly, his wits are sharpened, he has a feeling of strength, and experiments actually show that certain mental processes are stimulated, *e.g.* there is a nicer discrimination of nearly similar weights. If the dose has been large, the stage of exaltation of these or any other functions quickly passes into one of depression, the highest functions being affected first, and the stimulation and depression of function proceed regularly from the highest to the lowest. The action of alcohol thus illustrates both the fact that stimulation is usually succeeded by depression, and also the "law of dissolution," which (p. 108) states that functions which have appeared latest in the animal series of the individual are the most easy to influence, those which have appeared earlier are less easy to influence; and so by regular sequence till we arrive at the functions which are first developed, which are least to be influenced. The stimulation and subsequent depression of function therefore proceed in a descending scale from the highest or least firmly fixed function to the lowest or most firmly fixed. Thus the power of judgment is abolished very early by alcohol; this is so while the imagination, the emotions, and the power of speech still remain stimulated; but soon the power of imagination goes, the patient loses all command over his emotions, he cries and laughs irregularly, but this soon stops. He next begins to lose control over his speech, talking incoherently and thickly; shortly afterwards he cannot talk at all, but can only make noises. Muscular movements, which are not so firmly developed as those of speech, are next affected: delicate, lately developed movements, as writing or feeding himself, are for a time performed incoordinately, but soon they are paralysed. Next the muscular movements developed before these are implicated, and the patient cannot undress himself or walk straight, and incoordination of these movements passes into the inability to do them at all. Next the activity of the reflex centres of the cord is abolished, the patient passes his urine and fæces under him. Then the respiratory centre, which was previously stimulated, becomes paralysed, breathing is difficult, and the face is livid. Lastly, the heart, which was also at first stimulated, is paralysed, and the patient dies. The depression of the reflex centres of the cord accounts for the fact that injuries which would kill a sober man do not kill a drunken one, for the heart and respiration, owing to the general central depression, are not affected reflexly by them. Many consider that with alcohol and drugs of similar action (*e.g.* chloroform) the apparent stimulation of nervous centres is really due to depression of inhibition. All nervous depression is believed to depend upon a retraction of the terminal filaments of axons and dendrons, thus rendering synapses less intimate.

Muscular system.—Although alcohol is a food, its depressant effect on the nervous system is quickly seen in the depression of the power to do work, and although experiments on animals show at first a slight direct stimulation of muscular powers, and with some persons small doses perhaps at first stimulate the power of work, any action in this direction is slight, and is quickly followed by a depressant effect

THERAPEUTICS.

External.—Four parts of rectified spirit to one of water form the Lotio Spiritus of many pharmacopœias. Rags or lint dipped in it are applied to sprained joints, bruises, &c. The alcohol evaporates, cools the part, consequently the vessels contract, and inflammation may thus be checked. At the same time the local anæsthetic effect of the cold relieves

pain. In a similar way many varieties of head-
may be soothed by bathing the forehead with
r eau de Cologne or bay rum, which is the com-
name for Spiritus Pimentæ Co. B. P. C. and con-
f oil of pimento leaves, 0·75 ; oil of orange peel,
; oil of pimento, 0·05 ; alcohol, 64 ; kaolin, q.s. ;
r to 100. Brandy or some other form of alcohol
n used to bathe the skin in order to harden
abstraction of water and thus prevent the
tion of bed-sores or cracked nipples. Spirit
us dabbed on the skin may, by means of the
vascular contraction produced, stop sweating.
l rubbed in, as in the use of Linimentum
phoræ Ammoniatum, is commonly employed for
efacient effect, to aid the absorption of inflam-
y products and to relieve pain, as in chronic
matism, myalgia, &c.

Internal. *Mouth.* A little brandy held in the
will be a local anæsthetic and relieve tooth-
Alcohol is used in the form of a gargle of
ine for its power of precipitating albumen and
as an astringent in cases of chronic sore
, excessive salivation, or inflammation of the

Stomach. Because it increases the secretion of
juice, the vascularity and the movements of
mach, alcohol aids digestion and absorption.
t only be taken in small quantities, for large
paralyse the secretion and cause gastritis,
imately lead to atrophy of the gastric glands.
d be given just before or during a meal. It is
in acute dyspepsia, but for the indigestion of
d and feeble, or for those who are thoroughly
ed by overwork, it is very valuable, as the
h shares in the general exhaustion. It is also
ecause it increases the appetite, and it is a
which is absorbed without previous digestion.
to its anæsthetic property it may relieve

painful dyspepsia, and may check vomiting, especial
if taken with carbonic acid gas, as, for example,
the form of champagne or brandy and soda-wate
and because it increases the activity of the gastr
movements it may relieve flatulence. A single do
of strong spirits poured into the stomach is ofte
employed with great benefit for its reflex stimulan
effects on the circulation for those who have fainte
or who are collapsed from cold or any other cause.

Intestines.—Brandy and water will often che
diarrhœa. Perhaps this is owing to the astringe
power of the brandy.

Fever.—Alcohol has been largely used in all sor
of febrile conditions. We have seen that it impa
oxidation by its action on the red corpuscles, that i
oxidized and is therefore a food, that as a food it has
high caloric value, that it saves protein tissues, that
can be absorbed without taxing digestion, and th
it is mildly antipyretic and diaphoretic. These pr
perties would render it beneficial in fever. On
other hand, the acceleration of the pulse would
distinctly harmful, although it must be remem
that very often, for some unexplained reason, alc
lowers the pulse in fever; the indigestion caused
the taking of large quantities, and the liability
depression of the respiratory and cardiac cent
would be very undesirable. The best rules a
that while alcohol may be given often wi
advantage in fever, either to aid digestion, to
the pulse, as a cardiac stimulant if the patie
be much collapsed, or to produce sleep, yet it
in any of the ways alluded to do harm. Therefo
when it is being used the effect must be ca
watched, and if the pulse becomes quick and fee
or, as indicating gastric irritation, the tongue
comes dry and brown, or the skin becomes hot a
dry, or the breathing hurried, or the patient su
from insomnia, the alcohol should be stopped.

other hand, if the pulse becomes stronger and r, the tongue and skin moist, the breathing tran- and the patient sleeps well, the drug is doing and may be continued. We have so many powerful diaphoretics and antipyretics that l is not often given for these purposes. Of all it is most used for acute lobar pneumonia, and, ng generally, it is most likely to be valuable our object is to keep up the patient's strength few days only, till the termination of a specific of short duration; but it is often given when it te unnecessary.

rvous system. Alcohol may, as just men- be used as a soporific in fever. Many persons ffer from insomnia find that they can sleep for a glass of whisky and water just before to bed, no doubt because of its depressant upon the highest centres.

eys and Skin.—Alcohol is occasionally given diuretic. Gin is the best form, because it contains some juniper, which is also diuretic. gh but little alcohol is excreted by the s, it seems to be particularly irritant to the in cases of gonorrhœa and gleet, and some rities consider that chronic Bright's disease induced by alcohol. Almost the only use f its diaphoretic effect is as a help to cure a the head, for which purpose a strong glass of and warm water may be taken immediately going to bed.

TOXICOLOGY.

doses of alcohol will produce death, either instantly y stopping the heart, or later by cardiac and ry depression after absorption.

Chronic poisoning causes so many diseases that it is part of medicine. Very often confirmed drunkards, rly if they take much spirits, are very thin; this is due to the fact that strong spirits cause such marked ion that no nourishing food is absorbed. Other drunkards are fat, especially if they drink beer. Chronic gastritis, [illegible] of the [illegible], peripheral neuritis, delirium tremens, mania, and perhaps chronic Bright's disease, are all directly due to excessive indulgence in al[illegible] It renders patients particularly liable to phthisis, and [illegible] them bad subjects for withstanding any severe [illegible] especially pneumonia. Alcoholic beverages contain [illegible] bodies than alcohol, which are probably partly responsi[illegible] these evil effects.

CHLOROFORMUM.

Chloroform is Trichloromethane, $CHCl_3$, to which [illegible] cent. of [illegible].

SOURCE.—Obtained from ethylic alcohol, methy[illegible] spirit, or acetone by heating with chlorinated lime, [illegible] lime, and distilled water and subsequent purifica[illegible] Should be [illegible].

CHARACTERS.—A colourless, volatile, heavy liquid, [illegible] between 1·483 and 1·487, of a sweetish taste and a [illegible] odour. It imparts a green colour to flame. *Solubility.* 1 in 200 of water, in which it sinks in heavy drops; 10 in 7 of alcohol (90 per cent.); freely in ether, olive oil, or turpentine.

IMPURITIES.—Hydrocarbons, shown by darkening with sulphuric acid; non-volatile compounds, shown by not comp[illegible] evaporation, and by unpleasant odour; acids; free chlorine.

TESTS FOR PURITY.—(*a*) It must not redden blue litmus; (*b*) nor render cloudy silver nitrate; (*c*) nor give blue [illegible] with cadmium iodide and starch; (*d*) nor turn yellow when agitated for one hour with H_2SO_4.

Dose, 1 to 5 m. internally—**6 to 30 centimils.**

Preparations.

1. Aqua Chloroformi.—Chloroform, 2·5; dissolved in water, 1000.

Dose, ½ to 2 fl. oz.—15 to 60 mils.

2. Linimentum Chloroformi.—Equal parts of chloroform and camphor liniment.

3. Spiritus Chloroformi. *Synonym.*—Chloric ether. Chloroform, 1; alcohol (90 per cent.), 19. *Strength.*—1 in 20.

Dose, 5 to 20 m. 3 to 12 decimils for repeated administration. **30 to 40 m.—20 to 25 decimils** for a single administration.

4. Tinctura Chloroformi et Morphinæ Composita.—Intended to be an imitation of the proprietary medicine called chlorodyne. Mix chloroform, 75, tincture of capsicum, 25, tincture of Indian hemp, 100, oil of peppermint, 2, and glycerin, 250, with alcohol (90 per cent.), 450. Dissolve morphine hydrochloride, 10, in the mixture. Add to it diluted hydrocyanic acid, 50, and enough alcohol (90 per cent.) to make 1000. *Strength.*—1 millilitre contains chloroform, 7·5 centimils; morphine hydrochloride, 1 centigrm.; acidum hydrocyanicum dilutum, 5 centimils. 10 ♏ contains chloroform, ¾ ♏; morphine hydrochloride, $\frac{1}{11}$ gr.; Acidum hydrocyanicum dilutum, ½ ♏.

Dose, 5 to 15 m. 3 to 10 decimils.

N.B.—This preparation is very nasty, and not at all chlorodyne. Martindale's Liquor Chloromorphinæ is a imitation, and contains chloroform, morphine, atropine, and peppermint for active ingredients. Its dose is [illegible] m.

ACTION.

External. Chloroform in many respects acts like alcohol, but it is more powerful. Thus if allowed **to evaporate** on the skin it produces **cold**; therefore the vessels at the point of application contract, and at the same time **local anæsthesia** is induced. If the vapour be confined, or if chloroform be rubbed into the skin, it acts as an **irritant**. The vessels dilate, the part becomes red, and there is a sense of heat. This rubefacient effect may pass on to vesication. It is a powerful antiseptic and general protoplasmic poison.

Internal. *Mouth.*—If concentrated, it produces irritation and a burning sensation. If dilute, it has a **sweetish taste**, which renders Aqua Chloroformi a suitable vehicle for the administration of nauseous drugs. It reflexly gives rise to an increased secretion of saliva, and is a local anæsthetic.

Stomach.—The action of chloroform is **very** like that of **alcohol**. Large doses cause marked gastro-intestinal irritation. Small doses produce a feeling of warmth, dilatation of the gastric vessels, increased secretion of gastric juice, and more regular and more powerful gastric movements. It is perhaps slightly astringent to the intestines.

Absorption.—It is absorbed into the blood from the stomach and intestines, and, if given as vapour, from the lungs, but it is very uncertain what changes it subsequently undergoes. Probably most of it is combined with the cholesterin and lecithin of the red corpuscles, but some is certainly eliminated in the breath and some in the urine, it may be found in the blood of those who have been poisoned by it, and glycuronic acid may appear in the urine.

Temperature.—The temperature falls about 1°F. after the prolonged administration of chloroform.

Metabolism.—After its administration the nitrogen and sulphur in the urine are increased, indicating a greater destruction of protein. The chlorides in the urine, too, are increased, showing that some chloroform is decomposed in the body. If the patient be suffering from diabetes, the sugar in the blood and urine is much increased. Repeated inhalation of chloroform produces fatty degeneration, especially of the liver, heart, and kidneys, and prolonged over-indulgence leads to fibrosis of the same organs.

Excretion.—This takes place mainly by the lungs

Nervous system.—Chloroform is an excellent instance of the law of dissolution (*see* p. 108), and also of the well-known fact that drugs which in small doses appear to stimulate any part, in large doses often depress it. The phenomena resulting from the inhalation of chloroform are commonly divided into three stages. Here, as with alcohol, it is an open question whether the symptoms of stimulation are due to removal of inhibition or to direct stimulation.

First stage.—This is at first one of general stimulation, the highest functions being the most ulated, usually unevenly, so that the patient is what incoherent. The imagination is momen- excited, and he experiences a general feeling rmth and comfort spreading over the entire The mind, from the irregular excitation, is fused. Sight and hearing are stimulated, he riences sensations of light and hears noises. mulation of all these higher functions is very tory, and he quickly begins to lose conscious- he may be aware that people around him are without knowing what they are saying, but he hears and sees nothing. Sometimes during early part of this stage he may laugh or cry. nability to see and hear is quickly followed by lerable blunting of general sensation. At me time that these higher functions are being sed the lower motor functions are excited; ill kick and fight, throwing his arms and legs so that much strength may be required to him down, and he will shout and talk in- nt nonsense very loudly. Almost coincidently mulation of the lower centres sets in; the is increased in frequency, and there is bing of the heart and great vessels. The first ion or two may produce a choking sensation arrest of breathing, which is often voluntary; n the respirations are increased in frequency. lood-pressure at first rises a little, and the face flushed. The pupils usually dilate.

nd stage. This is best called that of de- n. Some authors call it the stage of excite- because the excitation of the motor centres continued into it. It is important to r that there is no sharp boundary line n the various stages: they pass insensibly into other. In this stage the depression of the functions continues, so that the patient s completely unconscious, and he appears to be in a deep sleep. He sees, hears, and feels nothing; hence chloroform is called a **general anæsthetic.** The excitement of the motor funct passes into depression, and he ceases to shout struggle. Some of the reflex centres are dep so that when the cornea is touched the eye doe shut. The pupil is contracted. The stimulatio the cardiac and respiratory apparatus gives wa depression, the pulse and respirations become frequent and less strong. The vaso-motor cen depressed, blood-pressure falls. As he cannot pain, and the reflex activity is so lowered th heart will not be reflexly inhibited by the shock operation, this is the period at which to operate

Third stage. In this there is a total abol of reflex excitability. Even the lowest reflex ce of the cord are depressed, so that the patient pass his urine and fæces under him; all mus tone is abolished, and consequently the muscle quite flaccid. Some of them, as those of the were probably in this condition towards the end the second stage. The pupil is widely dilat probably because of the commencing asphy This is the period to which the administration pushed to facilitate the reduction of dislocation to enable the abdominal viscera to be felt thr the abdominal wall. If still more chlorofor given, the depression of the cardiac, respiratory, vaso-motor centres continues, the pulse becomes f and irregular, and the heart finally stops in dia At last not only its central nervous apparatus b muscular tissue is depressed by the direct action the chloroform circulating in the coronary arter that it will not respond to mechanical stimul and by this period it is so dilated that, if the per dium is cut, the heart protrudes like a hernia. T unstriped muscle of the arteries is also depressed, and they dilate. The respiratory movements bec

and irregular, with very long pauses between
, and as a result the patient is more or less
yxiated. The blood pressure gradually falls to

There has been much dispute as to whether
oform kills by the heart or the respiration. The
ission appointed by the Nizam of Hyderabad
ated that it killed by depression of the respiratory
re, that respiration always failed before the heart,
that the fall of blood-pressure was not due to any
ct on the heart. But their results have been dis-
d, and it has been shown that chloroform may
denly kill by the heart owing to stimulation of the
centre in the medulla, even before breathing
ected, and that the fall of blood-pressure is mainly
a weakening effect on the heart, and to a less
nt to depression of the vaso-constrictor centre.
depression of respiration is merely the result of
fall of blood-pressure.

The recovery from chloroform also illustrates
law of dissolution. The lowest functions, such
uscular tone, are the first to reappear; but the
tient does not usually regain his mental equili-
m for hours. Chloroform and many drugs of the
thane series are especially soluble in lecithin and
lesterin, and this fact has been used to explain
r narcotic action (*see* p. 111).

With the exception of its local actions on the
nd alimentary canal, and its later effect on the
liac muscle, and that on the vessels, chloroform
entirely on the central nervous system, and this
n is not the result of any effects on the blood.
peripheral nerves are not affected, unless it be
t before death. Chloroform narcotizes infusoria.

Vomiting is very liable to occur during the
inistration of chloroform, and its advent is often
le known by pallor and wide dilatation of the
viously contracted pupil. Immediately before
th the pupil may be either dilated or contracted.

Therapeutics.

External. Chloroform is employed in the form of a liniment to produce rubefacient and irritant effects in cases of chronic rheumatism, myalgia, and chronic inflammations. A drop of chloroform to the fluid ounce of urine or of animal and vegetable infusions or decoctions will keep them from decomposition.

Internal. It may be used as a local anæsthetic for toothache, the tooth being plugged with a piece of cotton wool soaked in chloroform. It disguises the taste of nauseous medicines, and therefore Aqua Chloroformi is a very common vehicle, and Spiritus Chloroformi is much used as a flavouring agent. In the stomach it acts like alcohol, and is given in the same varieties of dyspepsia as are benefited by that drug. Small doses may be used as cardiac stimulants.

Inhalation.—It is inhaled to abolish sensations of pain, whether from surgical operations, biliary, renal, and intestinal colic, or parturition. In the last case not much need be given. It is also inhaled to relax muscular spasm, as in the reduction of dislocations or herniæ, or for the relaxation of muscles for diagnostic purposes, as, for example, when we wish to feel the abdominal viscera thoroughly, or to see whether a swelling is a phantom tumour; or, lastly, it is inhaled to relax spasm in cases of tetanus, hydrophobia, or in other varieties of convulsions, as chorea. The A.C.E. mixture, which consists of absolute alcohol 1 vol., chloroform 2 vols., and pure ether 3 vols., is very commonly employed for all these purposes. It is said to be safer than chloroform. All its three constituents volatilize from it at an equal rate.

The following points should be attended to in the administration of chloroform:

1. The respiration and pulse should be carefully watched for any signs of failure.

2. The operation should never be begun till x action is profoundly depressed, that is to say the stage of muscular relaxation has commenced. ny patients have been lost from neglect of this caution, for the stimulus of the knife has reflexly pped the heart. It is a common and dangerous or to think that, because the operation is trivial, may be begun early; most of the deaths from oroform have taken place when the operation has en slight.

3. Great care must be exercised if the heart be y or feeble from any cause, or if the patient suffer m disease of the lungs, or if he be very old.

4. In operations about the mouth care must be en to see that no blood gets down the trachea.

5. It is desirable to have the stomach empty, refore no solid food should be given for some rs before the administration. The patient's head t be so directed during vomiting that no vomited tters can get into the larynx.

6. False teeth should be taken out of the mouth.

7. The chloroform must be pure.

8. It should not be too concentrated, for if it is, heart may suddenly stop owing to stimulation of vagal centre. About 5 per cent. of chloroform 95 per cent. of air is a good mixture.

9. The head should be a little raised, and the er jaw held up so that the tongue shall not fall k over the larynx.

10. Special care must be taken when the opera- n necessitates awkward positions, especially if piration is interfered with, as in the lateral posi- n used in obstetric and renal cases.

11. Because the temperature falls the patient ould be kept warm.

If the pulse fails or the breathing becomes very ak, or stops altogether, artificial respiration should once be commenced, the tongue being pulled forward by forceps to allow free entry of air to the lungs. The face and abdomen should be flicked with wet towels, a capsule of amyl nitrite may be inhaled, and strychnine, ether, or brandy injected subcutaneously. It is doubtful whether galvanization over the cardiac area is of any use, perhaps it does harm. Artificial respiration should be maintained at least an hour or so, even if there is no sign of returning life, and if there is the slightest evidence of a cardiac beat, or a single automatic respiratory movement, artificial respiration must be persevered in for even many hours. If the face be pale, the head should be lowered, and amyl nitrite is especially likely to be useful. Atropine may be injected into a vein in the hope of accelerating the pulse slowed by action of the chloroform on the vagal centre.

Bromoform. $CHBr_3$. (Not official.)

CHARACTERS.—A limpid, colourless, sweet liquid. [illegible] in alcohol, very slightly in water.

Dose, ½ to 2 m.—3 to 12 centimils.

ACTION AND THERAPEUTICS.

Bromoform is used for whooping cough. It diminishes the severity and number of the paroxysms. Many cases of poisoning are on record, for it is almost insoluble in water, and having a sp. gr. of 2·9 it sinks to the bottom of a [illegible] mixture, and is all taken in the last dose. This is best got over by dissolving it in alcohol. Thus: bromoform [illegible], alcohol (90 per cent.) 7·5, glycerin 30. This will mix with water, and most other drugs, without precipitation of bromoform, and may be flavoured with orange and cardamoms as in Elixir Bromoformi (B.P.C.). Dose, ½–2 fl. dr. (2–8 mils). Bromoform may be suspended in a [illegible] mixture if dissolved in thrice its volume of almond oil. The symptoms of poisoning are the same as those of chloroform.

ÆTHER.

Ethylic Ether, or Ethyl Oxide. $C_4H_{10}O$.

Synonym. Sulphuric ether.

SOURCE. Prepared by distilling a mixture of ethylic alcohol or industrial methylated spirit with sulphuric acid, and rectifying the distillate.

CHARACTERS.—A colourless, light, volatile liquid, with a t taste and peculiar odour. It is very inflammable, boil en 34° and 36° C., and burns with a white flame. Sp 72.

IMPURITIES.—Water, alcohol, and fixed impurities.

Dose, 15 to 30 m. 1 to 2 mils—for repeated adminis- n; **45 to 60 m.—3 to 4 mils**—for a single administra

Preparations.

1. **Æther Purificatus.**

2. **Spiritus Ætheris.**—Ether, 1 part; alcohol (90 per cent.), 2 parts. Sp. gr. 0·802 to 0·806.

Dose, 20 to 40 m.—12 to 25 decimils—for repeated, **60 to 90 m. 4 to 6 mils**—for single administration.

3. **Spiritus Ætheris Compositus.** (Not official, but official B. P. 1898 and often used.) *Synonym.* Hoffmann's anodyne. Mix sulphuric acid 36 fl. oz. with alcohol (90 per cent.), 40 fl. oz. A complex ethereal compound called oil of wine is formed. It is chiefly ethyl hydrogen sulphate, and is thus produced: $C_2H_5OH + H_2SO_4 = C_2H_5HSO_4 + H_2O$. After twenty-four hours slowly distil the mixture. The distillate contains water, sulphur dioxide, ethylene, and a little oil of wine. Add water to the upper layer of distillate after it is removed from the lower, then shake it with sodium bicarbonate to neutralize the acid. Separate the ethereal liquid, which consists chiefly of oil of wine, add to it ether, 5½ fl. oz., and alcohol (90 per cent.), 38 fl. oz.

Dose, 20 to 40 m.—12 to 25 decimils—for repeated, **60 to 90 m.—4 to 6 mils**—for single administration.

ACTION.

External.—Ether evaporates very quickly, pro- ing **great cold**, and consequently the part to which has been applied becomes white from the contrac- n of the vessels. The cold is sufficient to cause h marked **local anæsthesia** that the pain of very ht operations performed upon the part anæsthetized hardly be felt. To produce this result ether is best applied as a fine spray. If it be rubbed in, or evaporation be prevented, it, like alcohol or chloroform, is an **irritant**.

Internal. In the mouth and stomach also it acts like **chloroform** or **alcohol**. Thus ether causes a burning taste in the mouth, an increase of the saliva, of the gastric secretion and gastric movements, and dilatation of the vessels of the stomach. Consequently it is carminative and aids digestion. Directly it reaches the stomach it **reflexly** excites the heart, increasing the force and frequency of the pulse, and causing a rise of blood-pressure; it is one of the best **cardiac stimulants** we have. In the same way it excites respiration. It is quickly absorbed, and its stimulating influence on the heart and respiration is continued. It is thus a good instance of a rapidly diffusible stimulant. It is also antispasmodic.

Nervous System. Ether is a powerful **general anæsthetic.** The phenomena and stages of ether anæsthesia are so like those of chloroform anæsthesia that the description already given (p. 298) will suffice. The following differences, however, should be noticed:

(1) The heart is paralysed with much greater difficulty by ether than by chloroform.

(2) The same is true of the vaso-motor centre.

(3) And also of the respiratory centre.

(4) Ether is much more irritant to the respiratory mucous membrane, and hence is more liable to increase bronchitis in those already suffering from it.

(5) With ether the stage of stimulation is more protracted, therefore there is more struggling.

(6) For the same reason the anæsthetic stage is not reached so soon.

(7) The reduction of temperature is greater with ether.

(8) Ether must be given nearly pure, about 30 per cent. of air to 70 of ethereal vapour; hence it is more difficult to administer.

(9) The smell of ether is more disagreeable, and tients dislike it more.

(10) Ether is eliminated more slowly, and hence smell hangs about the patient some time.

11) Ether being very inflammable cannot be l in the close neighbourhood of a naked light.

THERAPEUTICS.

External.—Ether, allowed to evaporate, may be l to cause local anæsthesia in cases of neuralgia. ther spray is occasionally employed to produce l anæsthesia for small operations; but as the r makes the skin hard and brawny the operation be quite superficial, and even then there is ch subsequent tingling and pain.

Internal.—*Stomach.*—It may be used for the e classes of dyspepsia as chloroform or alcohol, l is often employed as a carminative to expel gas latulent dyspepsia.

Heart.—Administered subcutaneously (dose, 10 5 ♏, 6 to 10 decimils) or by the mouth, ether is an llent cardiac stimulant of great value in fainting, diac failure, or palpitation, its advantage over roform and alcohol being that it is more rapid in action. It is very useful as an antispasmodic ng an attack of asthma. Spirit of ether with an l part of aromatic spirit of ammonia and some r forms an excellent restorative.

Inhalation.—Ether is inhaled for the same pur- s, and with the same precautions, as chloroform. re is some divergence of opinion as to which is safer anæsthetic. All the published statistics in ch the two are contrasted appear to show that r is much safer, and this is what might have n expected from the contrast between the two ly given. Chloroform is administered carelessly often than ether, as it is easier to give, but even allowing for this ether is probably on the whole safer. The nausea and vomiting which sometimes follow th administration of ether may, it is said, be checked giving 15 grains of sodium bromide. Very oft anæsthesia is commenced with a few inhalation nitrous oxide gas, and then completed with ether. This is much pleasanter for the patient than to ether from the first.

ETHYL CHLORIDE.

Ethyl Chloridum. C_2H_5Cl. *Synonyms.*—Hyd chloric ether. Kelene.

SOURCE.—May be obtained by the action of hydroch acid on ethylic alcohol, or on industrial methylated spirit

CHARACTERS.—Gaseous at normal temperature pressure, but as usually supplied is condensed into a colo less, mobile, inflammable, very volatile liquid.

USES.

This substance has a low boiling-point, and produces intense cold by its evaporation. It is in glass capsules terminating in a fine tube with screw-capped point. When the capsule is held with the fine tube pointing towards the part to be anæsthetized, at about eight inches from it, the liquid ethyl chloride by its own vapour pressure is forced out as a fine jet, which impinges on the skin of the patient, and by its evaporation produces enough local anæsthesia for the performance of small operations, such as the removal of small warts. All fat must be removed from the skin by soap and washing with ether. Ethyl chloride is inflammable. It may be given by inhalation as a general anæsthetic.

Methyl Chloride (Not official) is used in the same way to produce local anæsthesia and to relieve pain of neuralgia, &c. The vapour is allowed to play obliquely on the skin for four or five seconds.

Anestile (Not official) is a non official mixture of methyl chloride and ethyl chloride, and is used in the same way as ethyl chloride as a local anæsthetic.

Ethyl Bromide (Not official) is used as a general anæsthetic for short operations [illegible] nitrous oxide. N[illegible] [illegible] ethylene bromide.

ÆTHER ACETICUS.

Acetic Ether.

A liquid obtained by distillation of a mixture of ethylic alcohol, acetic acid and sulphuric acid, and purifying the product. It contains not less than 90 per cent. of ethyl acetate, $C_2H_5C_2H_3O_2$.

CHARACTERS.—A colourless fragrant liquid. Sp. gr. 0·9 to ·907. *Solubility.*—1 in 10 of water; freely in alcohol or ether.

Dose, 15 to 30 m.—1 to 2 mils for repeated administration; **45 to 60 m.—3 to 4 mils** for a single administration.

ACTION AND THERAPEUTICS.

It acts like ether, as a stimulant, antispasmodic, and carminative, but has a pleasanter taste.

ACETONUM.

Acetone or Dimethyl-ketone, C_3H_6O.

SOURCE.—May be obtained by the dry distillation of calcium acetate, or barium acetate.

CHARACTERS.—A colourless, transparent, mobile and volatile liquid. Characteristic odour; taste pungent and sweetish.

It is used as a solvent for cantharidin in *Liquor Epispasticus*.

ACTION AND THERAPEUTICS.

Its action is almost the same as that of ethylic alcohol. It is a useful solvent for resins, fats, cantharidin, celluloid, &c. Hypnone is acetophenone or phenyl-methyl-ketone; it has been given as an hypnotic, but there are many much better.

NITROUS OXIDE.

Nitrous Oxide Gas. N_2O. (Not official.) *Synonym.* Laughing Gas.

SOURCE. Prepared by heating ammonium nitrate.

CHARACTERS. A colourless, inodorous gas. It is supplied in the liquid form in steel cylinders under a pressure of 50 atmospheres. It is not chemically allied to other anaesthetics, but is considered here for convenience.

ACTION.

The gas is always administered by inhalation. Outside the body it supports combustion, but it is not of the same use to living tissues as oxygen, and if it replaces oxygen it leads to asphyxia owing to the absence of oxygen.

Nervous System. When the gas is inhaled, the patient experiences, after a few seconds, a rushing noise in the ears, and indistinctness of vision. He feels he is losing control of his higher faculties; he has a great desire to laugh, and feels happy; his speech and other movements are incoordinate; respiration becomes difficult, and by the time inhalation has lasted about 30 seconds he is cyanotic, and the following additional evidences of asphyxia are often present, viz.: jerky, grunting stertor, muscular clonic twitchings, irregularity and finally stoppage of respiration. The face piece must be removed when cyanosis begins to appear, and it will be seen that there is no corneal reflex; the eyes are fixed, and the pupils dilated. The patient is also now completely anaesthetized, so that he does not feel a short operation, such as the withdrawal of a tooth. Very soon after the removal of the face piece he takes a deep breath, and the lividity disappears. The stage of anaesthesia lasts from 20 to 40 seconds, and after it the patient wakes in two or three minutes, and suffers from no after-effects.

It will be noticed that we have here the stage of excitation followed by depression. Whether the excitation is due to direct stimulation of the central nervous system or to removal of inhibition is undecided. To some extent the gas depresses the nervous system by cutting off oxygen, but Bert showed that, if administered under increased pressure with oxygen, so that there was plenty of oxygen in the blood, anæsthesia was nevertheless produced; therefore the gas has a direct effect on the nervous system, possibly, as Dixon suggests, owing to its easy solubility in the fats there present.

Circulation.—Nitrous oxide has no direct influence on the heart. The rise of blood pressure and the slowness of the pulse are due to asphyxia. It is simply dissolved in the blood; the amount there corresponds to the partial pressure of the gas in the lungs.

Respiration.—The asphyxia is chiefly due to deprivation of oxygen, for the gas replaces much of that in the blood. The glycosuria that occasionally occurs after its administration is due to the asphyxia.

THERAPEUTICS.

Nitrous oxide is used solely to produce anæsthesia for short operations. The steel cylinders in which the liquefied gas is contained have a tap which is worked by the administrator's foot. The liquid is vapourized directly it escapes from the cylinder, and it passes into a large indiarubber bag, from which the patient inhales it by a mask, with a valve so arranged that, while he can inspire from, he cannot expire into, the bag. It is found that if air, or still better oxygen, is inhaled at the same time as the nitrous oxide, we can produce the direct depressant effects of the gas on the central nervous system without the asphyxial symptoms, therefore pure nitrous oxide is rarely employed, but an apparatus devised by Hewitt, by means of which oxygen and nitrous oxide in varying proportions can be administered, is used; by it patients can be kept anæsthetized for a long while.

Class III. **Nitrites.**

Spiritus Ætheris Nitrosi, Amyl Nitrite, Nitroglycerin, Sodium Nitrite, Ethyl Nitrite, Erythrol Nitrate.

All these dilate the peripheral vessels, and increase the rapidity of the heart.

SPIRITUS ÆTHERIS NITROSI.

Spirit of Nitrous Ether. *Synonym.*—Sweet spirit of nitre.

This is a solution in alcohol of several substances, the chief being ethyl nitrite, aldehyde, paraldehyde, acetic acid and acetic ether.

Source.—Distil a mixture of alcohol (90 per cent.), nitric acid, sulphuric acid, and copper, and dissolve the distillate in alcohol (90 per cent.). Probably what happens is this: Copper nitrate is first formed and hydrogen set free. This reduces some nitric acid to nitrous acid; this reacts with ethyl alcohol, forming ethyl nitrite and water. The copper nitrate first formed is decomposed by the sulphuric acid, nitric acid being regenerated and copper sulphate produced. The distillate consists of a mixture of ethyl nitrite, alcohol, and its oxidation products.

Pure ethyl nitrite can be kept any time, but Spirit Ætheris Nitrosi should be preserved in the dark in small hermetically sealed bottles, for it soon becomes acid. Much that is sold is not prepared according to the pharmacopœial directions.

Characters.—Transparent, nearly colourless, mobile, inflammable, slightly acid liquid of an apple-like odour and a sweet cooling taste. *Strength.* According to the Pharmacopœia it must contain between 2·66 and 1·52 per cent. of ethyl nitrite. Sp. gr. 0·838 to 0·842.

Incompatibles.—Potassium iodide, iron sulphate, tincture of guaiacum, gallic and tannic acids, antipyrin, and emulsions.

Impurity.—Excess of acetic acid.

Dose, 15 to 60 m. 1 to 4 mils.

Action.

External.—Spirit of nitrous ether evaporates when it is applied externally, and a slightly anæsthetic effect is produced.

Internal. It combines the action of the ether with that of the nitrites contained in it. Because of the ether it is a **diffusible stimulant**, a **stomachic**, and a **carminative**. Because of the nitrites it acts like amyl nitrite; but as the ethyl nitrite is so diluted, its action in this direction is feeble: thus it only **moderately dilates the vessels**, and except in poisonous doses probably does not affect the blood. The dilatation of the vessels leads to a **diaphoretic** effect on the skin, a **diuretic** effect on the kidneys, and a lowering of arterial blood pressure. The dilatation of the cutaneous vessels, the sweating, and perhaps the changes in the blood, produce a slight antipyretic influence. It is obvious that in these effects the nitrites will to some extent be aided by the ether.

THERAPEUTICS.

For its diaphoretic and slight antipyretic effects it is commonly given in mild febrile attacks, such as a common cold. It is also used as a diuretic in chronic Bright's disease, and cardiac and pulmonary diseases accompanied by œdema.

AMYL NITRIS.

Amyl Nitrite.

SOURCE.—Produced by the interaction of nitrous acid and amylic alcohol that has been distilled between 128° C. and 132° C. It consists chiefly of isoamyl nitrite, $C_5H_{11}NO_2$, but also contains other nitrites of the homologous series.

CHARACTERS.—An ethereal liquid of a pale yellow colour, and smelling strongly like the sweetmeat pear drops, which are flavoured with amyl acetate. Sp. gr. 0·87 to 0·88. Very volatile. Soluble in ether, chloroform, or spirit, but not in water.

IMPURITIES.—Free acid and amyl nitrate.

Dose, 2 to 5 m. 12 to 30 centimils—cautiously inhaled from a handkerchief in which a glass capsule containing the nitrite of amyl has been crushed.

ACTION.

External.—Locally applied it diminishes the activity of the sensory nerves, but they quickly recover.

Internal.—Amyl nitrite is rarely given by the mouth, so the following account will refer to the effects of inhalation. The effects of a single inhalation pass off in two or three minutes.

Circulation.—From a medical point of view by far the most important effects of amyl nitrite are those produced upon the heart and vessels. Within a minute of inhalation the **face flushes**, the **heart** beats very **rapidly** and **violently**, there is a throbbing in the head, and the vessels, *e.g.* the carotids, may be seen to pulsate actively. Headache, giddiness, dilatation of the pupils, and increased respiratory movements quickly supervene. The vessels of the body rapidly dilate, but of the cutaneous vessels only those of the head and neck are affected, hence the flushing. The vessels may be actually seen to widen in the ear of a rabbit or in the retina. This is due to a direct action on the arterioles, for it happens if the cord is destroyed. It is the unstriped muscles of the arterioles, and not the ends of the nerves, which are affected. The blood-pressure and arterial tension of course fall very low. The increase in the rate of the pulse is unaccompanied by any alteration in the force of the beat; it is apparently due to a depressing influence on the inhibitory vagus centre, possibly as a result of lowered blood pressure. In toxic doses the heart may be arrested in diastole from direct action on the cardiac muscle.

Respiration.—The rapidity and depth of respiration are at first somewhat increased, probably from central stimulation; the respiratory centres are later depressed, the breathing becoming slower and allower, and usually death finally occurs from ralytic asphyxia of central origin.

Nervous system.—Many of the symptoms refer le to the nervous system are secondary effects of dilatation of the vessels of the brain and spinal rd. Such are the throbbing, sense of fulness, ldiness, and headache noticed directly after in lation. The headache may remain some time. If much has been inhaled there is unsteadiness of it and general restlessness. The pupil dilates, l disturbances of vision are present. The motor ntres of the cord are profoundly depressed, there re after large doses reflex actions are abolished. The function of sensory nerves, motor nerves, and cles is depressed by the local application of the ug to them, but not after inhalation until shortly fore death.

Temperature.—Amyl nitrite causes this to fall nsiderably both in fever and health. The fall due to the peripheral vascular dilatation, and, if rge doses are given, to the changes in the blood.

Urine.—The drug probably escapes in the urine nitrites and nitrates; it is slightly diuretic, and ty cause glycosuria, due, it is said, to dilatation of he vessels of the liver or of the medulla.

Blood.—Nitrites given in medicinal doses circu- te as sodium nitrite. Outside the body they greatly minish oxidation, and the same takes place in blood. After the inhalation of a considerable mount (more than is usually given to a man) the rial and venous blood both become a uniform ocolate colour. This is due to the formation of thæmoglobin and another body, probably nitric ide hæmoglobin. The hæmoglobin can no longer sorb oxygen, and hence its oxidizing power is olished. It is by this action on the blood that in an nitrites kill, not by their vaso-dilator action; herefore the treatment for poisoning by them is inhalation of oxygen, that more may be dissolved in the plasma. In some of the lower animals they kill by acting as a direct poison to animal tissues.

THERAPEUTICS.

Heart and Blood-vessels.—Brunton in 1867 observed that in a case of angina pectoris the peripheral vessels were strongly contracted during an attack of pain. This induced him to make the patient inhale amyl nitrite, and it was found that the vessels dilated and the pain passed off. Inhalation of amyl nitrite is now used for all sorts of cardiac pain, especially when it comes on in paroxysms. Generally the drug affords relief in a minute or so after inhalation, but by no means always. We do not sufficiently understand the pathology of angina pectoris to know how it acts. It may be by dilating the peripheral vessels, but against that view is the fact that they are not always contracted during attacks of angina pectoris; amyl nitrite may relieve patients in whom the vessels are not contracted. The attacks of pain common in thoracic aneurysm may be relieved by it. It is successfully used to avert the dangerous pallor sometimes seen during the administration of chloroform, and may be inhaled for other forms of syncope. The peculiar hot flushes experienced by some women during the menopause are benefited by inhalation of it. It is said to be useful, by lowering the blood pressure, in hæmoptysis and other varieties of severe hæmorrhage.

Nervous system.—If it is inhaled when the aura is felt, an epileptic fit may sometimes be prevented, and it has also been found useful during the status epilepticus. Because in migraine the vessels of the head are contracted, it has been used, and sometimes successfully, for this complaint. Its depressing action [illegible] the cord has suggested its employment in tetan[illegible] [illegible] strychnine poisoning.

Occasionally the inhalation of amyl nitrite re[illegible]es an attack of asthma. It has been given in whooping-cough, sea-sickness, and cholera, but with [illegible] much good effect.

NITROGLYCERIN.

Trinitroglycerin. $C_3H_5[(NO_2)O]_3$. (N[illegible]

Synonyms. Trinitrin. Gl[illegible]

SOURCE.—Glycerin [illegible] of [illegible] nitric acids kept cool by [illegible]

CHARACTERS.—A colourl[illegible] Sp. [illegible] 1·6 [illegible] in water, easily in fat [illegible] Mixed with silica forms dynamite.

Dose, $\frac{1}{200}$ to $\frac{1}{40}$ gr.—0·3 to 1·5 milligrms.—never [illegible]ated.

Preparations [illegible]

1. Liquor Trinitrini. Nitroglycerin, 1; alcohol (90 per cent.), 100. *Strength*, 1 per cent. Sp. gr. 0·840.

Dose, $\frac{1}{2}$ to 2 m.—3 to 12 centimils.

2. Tabellæ Trinitrini. Nitroglycerin, 0·5 [illegible] grm.; chocolate, 0·3 grm. Chocolate [illegible] with it there is no risk of explosion. Each contains [illegible] gr. of nitroglycerin.

Dose, 1 or 2 tablets.

ACTION AND THERAPEUTICS.

Its action is the **same as** that of **amyl nitrite**, except that in many animals and probably in man [illegible] doses do not form methæmoglobin in the blood. [illegible] effects of nitroglycerin are **more persistent**, and [illegible] is only suitable for administration by the mouth [illegible] are slower in their onset. It is frequently taken [illegible] persons liable to cardiac pain, with the object of [illegible]ding off the attack, and often such persons re[illegible] and bear large doses. Small doses are often used to lower the arterial tension in chronic interstitial nephritis. Occasionally it does good in asthma. It is really a nitrate of glycerin, but certainly physiologically it belongs to the class of nitrites; therefore, probably, directly it gets into the blood, sodium nitrite is formed.

SODII NITRIS.

Sodium Nitrite. $NaNO_2$.

Source.—Made by fusing sodium nitrate with lead which becomes an oxide, taking oxygen from the nitrate.

Characters.—A white crystalline deliquescent powder, very soluble in water.

Dose, ½ to 2 gr.—3 to 12 centigrms.

LIQUOR ETHYL NITRITIS.

Solution of Ethyl Nitrite.

A mixture of 95 parts by volume of absolute alcohol with 5 parts by volume of glycerin, containing, when freshly made, 3 per cent. by weight, and even when long kept not less than 2½ per cent. of ethyl nitrite.

Source.—Obtained by the interaction of alcohol (90 per cent.), sodium nitrite, and diluted sulphuric acid at a low temperature.

Characters and Tests.—A limpid, almost colourless liquid with characteristic apple-like odour and taste. Highly inflammable. Sp. gr. 0·823 to 0·826. Should be stored in small bottles.

Dose, 15 to 60 m.—1 to 4 mils.

ACTION AND THERAPEUTICS.

The action of sodium nitrite and ethyl nitrite is the **same as** that of **amyl nitrite** and other nitrites. They are suitable for the same cases as nitroglycerin, as they are **slower and gentler** in their action than amyl nitrite. Sodium nitrite has the same action on the blood as amyl nitrite.

ERYTHROL NITRAS. (Not official.)

Erythrol Nitrate. *Synonym.*—Erythrol tetranitrate.

Characters.—Hard colourless acicular crystals. *Solubility.* Not in water; 1 in 60 of absolute alcohol.

Dose, ½ to 1 gr.—3 to 6 centigrms.

Erythrol nitrate has the same action as nitrites. It is less powerful than nitrite of amyl and nitro-glycerin. It is best given in chocolate tablets, and, as its action is slow, it is the best of this group for Bright's disease.

Class IV.—**Hypnotics.**

Chloral Hydras, Butyl-chloral Hydras, Chloretone, Chloralose, Chloralamide, Paraldehydum, Sulphonal, Trional, Tetronal, Veronal, Medinal, Adalin.

CHLORAL HYDRAS.

Chloral Hydrate, $C_2Cl_3H_3O_2$.

Source.—Ethylic alcohol is saturated with dry chlorine, and thus chloral C_2Cl_3HO is formed. It is purified and water is added to form a hydrate.

Characters.—Colourless monoclinic plates of a pungent, peculiar odour and a bitter taste. Easily melted by gentle heat. *Solubility.*—Freely in distilled water, alcohol (90 per cent.), and ether. Forms a fluid when rubbed up with an equal weight of camphor.

Incompatibles.—All alkalies decompose it.

Impurities.—Hydrochloric acid and oily impurities.

Dose, 5 to 20 gr.—3 to 12 decigrms.

Preparation.

Syrupus Chloral. Choral hydrate, 1; distilled water, 1; syrup to produce 5. *Strength.*—10 millilitres contain 2 grms. of chloral hydrate; 1 fl. dr. contains 10·9 grs.

Dose, ½ to 2 fl. dr.—2 to 8 mils.

ACTION.

External.—It is a powerful **antiseptic.** Locally applied it is irritant, causing vesication.

Internal.—*Alimentary canal.*—Unless diluted, chloral hydrate is a gastric irritant; large doses therefore may give rise to vomiting and purging.

Blood.—It is readily absorbed, and circulates in the blood unchanged. It was formerly thought that as alkalies convert it into chloroform and formic acid, this change would take place in the blood, and consequently Liebreich suggested its use as an hypnotic. It is now known that this view is wrong; for no chloroform can be found in the blood of chloralized animals, nor in the breath, nor in the urine unless that fluid is alkaline, in which case chloral hydrate is decomposed by the alkali in the urine.

Circulation.—Chloral hydrate **depresses the heart**, large doses having this action to a considerable degree. This is due to a local effect on the organ itself; probably both the muscular substance and the nerves contained in it are affected. The pulse, which may at first be slightly quickened, soon becomes slow, feeble, and irregular, and the heart finally stops in diastole. The **vaso-motor centre is depressed**, and consequently the vessels dilate. As a result of these actions on the heart and the vessels the **blood-pressure falls.**

Respiration.—After large doses the respirations become slow and full, and after toxic doses they become irregular and shallow before finally ceasing. This is due to the action of chloral hydrate on the respiratory centre.

Temperature.—Large doses cause a fall by diminishing the production and increasing the loss of heat.

Brain.—Chloral hydrate is a **powerful hypnotic**, acting directly on the brain. The stage of excita-on, if it exists, is very short. Soon after taking a moderate dose the patient is overcome by sleep, which lasts several hours, and is indistinguishable from natural sleep. On waking there is neither confusion nor headache, and he feels refreshed. Large doses produce coma. The pupil is always contracted.

Spinal cord.—At first the anterior cornua may be slightly stimulated, but soon they are depressed, and there is consequently paralysis and loss of reflex excitability. The motor nerves and the muscles are not affected, nor are the sensory nerves unless the dose is very large, when there may be anæsthesia.

Metabolism. Prolonged large doses lead to fatty degeneration of the tissues and to an increase of nitrogen, phosphorus, and sulphur in the urine, indicating an excessive breaking down of protein tissues. The urine reduces Fehling's solution; this is due to the presence of urochloralic acid, not to sugar, as was formerly thought.

It will be observed that chloral hydrate is a **powerful general depressant**, chiefly of the cerebrum, but also of the respiratory centre, the vaso-motor centre, the anterior cornua, the production of heat, and the heart. It is only because it depresses the cerebrum much earlier than any other part of the body that we can use it as an hypnotic. Chloral hydrate is often called chloral, but this is an oily liquid.

THERAPEUTICS.

External. The compound with camphor has been employed as a local anodyne for neuralgia, and may be applied to aching teeth.

Internal. Chloral hydrate is largely used for its hypnotic effect. Its great advantages over many other hypnotics are that doses sufficient to produce a deep sleep are not large enough to cause gastro-intestinal irritation, cardiac and respiratory depression.

and the other harmful effects. Chloral hydrate i certain in its action; it quickly produces sleep; an there are no bad after-effects. Children take it wel

It is especially useful in simple insomnia fro overwork or worry. Its disadvantages are that does not relieve pain at all, and it should therefore n be used for insomnia due to this cause; and that, as i depresses the heart and respiration, it must be give carefully in diseases of the heart and lungs, and als when the stomach or intestines are diseased, as may irritate these structures. In febrile insomnia i is very valuable in the early stages, but must b given cautiously later when there is any danger cardiac weakness. It does not relieve the distres and cough of diseases of the heart and lungs. I has been used as a cerebral depressant in deliriu tremens, puerperal convulsions, and mania, but ve large doses are required, and consequently the result must be watched with great care.

From its action on the spinal cord chlora hydrate has been used, and sometimes with succes in tetanus, whooping-cough, incontinence of urin and strychnine poisoning.

Hypnal (dose, 15 gr., 1 grm., in a cachet) is compound of chloral hydrate and antipyrine whic has been used to produce sleep when pain is present.

TOXICOLOGY

Acute Poisoning.—As will be inferred from the acti of chloral hydrate, the symptoms of poisoning by it are de coma: a weak, feeble, irregular, slow pulse, which may bec quick before death; diminished frequency of respiration a consequent lividity: and abolition of reflex movements. Th surface of the skin is cold, and the temperature is subnorma

Treatment. Give emetics (see p. 145) or wash out th stomach. Keep up the temperature by hot bottles, h blankets, friction, and massage. Prevent sleep by the injectio of hot strong coffee into the rectum, shouting at the patien hitting him, flapping with wet towels, bathing, &c. Give subcutaneous injection of strychnine, because of its stimulan action on the anterior cornua. Use inhalations of amyl nitrite to stimulate the heart, and artificial respiration if necessary.

Chronic poisoning. The taking of chloral hydrate is a vice to which many persons are addicted. A craving for it is soon established. The chief symptoms of chronic chloral poisoning are gastro-intestinal irritation, a great liability to erythematous eruptions, dyspnœa dependent upon the cardiac and respiratory depression, and general weakness. There may be disturbance of the mental equilibrium, and persons have been known to become permanently weak-minded. A slightly larger dose than usual may be quickly fatal.

BUTYL-CHLORAL HYDRAS.

Butyl-chloral Hydrate. Trichlorbutylidene Glycol.

$C_4H_7Cl_3O_2$.

Synonym. Croton chloral hydrate. (This is a misnomer.)

Source. Dry chlorine gas is passed through aldehyde; butyl-chloral is formed. It is separated by fractional distillation, and water is added.

Characters.—Pearly white crystalline scales, with a nauseous taste and a pungent odour like chloral hydrate. *Solubility.* 1 in 50 of water; freely in spirit and glycerin.

Incompatibles.—All alkalies.

Dose, 5 to 20 gr. 3 to 12 decigrms.

Action and Therapeutics.

The action of this drug is exactly similar to that of chloral hydrate, but it is less certain in its effects. It is said to be less depressant to the heart, and to have a specific action in relieving neuralgia of the fifth nerve, but both statements are doubtful.

CHLORAL FORMAMIDE.

Chloral Formamidum. $C_3H_4Cl_3NO_2$. *Synonym.* Chloralamide.

Source. Formed by the direct combination of formamide with anhydrous chloral. Should be preserved in amber coloured bottles.

Characters. Shining colourless crystals. Taste slightly bitter. *Solubility.*—Slowly in about 1 in 20 of water, 1 in of alcohol (90 per cent.), and in weak acid solutions. Sho not be heated over 140° F., or mixed with alkalies, for either case it decomposes.

Dose, 15 to 45 gr. 1 to 5 grms.

ACTION AND THERAPEUTICS.

Chloralamide is an excellent hypnotic, producing calm refreshing sleep without any bad after-effects. It has little or no cardiac, vaso-motor, or respiratory depressant action. In the blood it is decomposed into chloral and formamide, and may be that the latter prevents the depressant action of the chloral. Frequent use does not necessitate an increased dose, nor, as far as we know, is any chloralamide habit contracted. It does not relieve pain, but is equally serviceable for all varieties of insomnia unless due to pain. If possible it should not be given as a powder, for it is then so very slowly absorbed that probably some of it is decomposed in the intestines or stomach; occasionally, when powdered chloralamide has been administered in the evening, the patient has not slept during the night, but has slept all the next day, because the drug has been so slowly absorbed. The best way to give it is to dissolve it in a little alcohol. The patient may be told to dissolve 20 or more grains in sufficient brandy, to add water not above 130 F. (55° C.), and drink it before going to bed. It will require stirring for some time. Some specimens are very insoluble, and must be suspended. It is said that 10 minims (6 decimils) of aromatic sulphuric acid added to 1 fl. oz. (30 mils) of water will dissolve 30 gr. (2 grms.) of chloralamide, but this is not always true. The Mistura Chloralamidi Co. (B. P. C.)—dose, ½ to 1 fl. oz. (15 to 30 mils), which contains potassium bromide, is often useful. It acts if given as an enema. Fifteen grains (1 grm.

f each of potassium bromide and chloralamide, lavoured with tincture of orange and chloroform water, has been strongly recommended for insomnia and for sea-sickness. This mixture resembles a proprietary preparation called chlorobrom.

Chloralose. (Not official.)

Synonym. Anhydro-glyco-chloral.

CHARACTERS.—Small white bitter crystals, slightly soluble water.

Dose, 3 to 10 gr. 2 to 6 decigrms. in a cachet.

ACTION AND THERAPEUTICS.

This drug is soporific, having a similar action to chloral, cept that, in large doses, it produces increased reflexes and onvulsions; but it is less depressant, and may be given in ses of heart disease. It is also useful in asylum practice.

Chloretone. (Not official.)

Synonyms.—Chlor-butyl-alcohol. Chlorbutol.

CHARACTERS.—White needles, sparingly soluble in water.

Dose, 5 to 20 gr. 3 to 12 decigrms. in a cachet.

ACTION AND THERAPEUTICS.

It is a local anæsthetic, and 5 grains may be used, made nto a suppository, for piles, and 1 part with 10 of zinc oxide rms a dusting powder for painful sores, as burns. Internally hloretone is a good hypnotic, and has been used for sea ckness.

PARALDEHYDUM.

Paraldehyde. $C_6H_{12}O_3$.

SOURCE.—A product of the polymerization of acetaldehyde.

CHARACTERS.—A colourless liquid of ethereal odour and rning taste. Sp. gr. 0·998 to 1·000. *Solubility.* 1 in 10 f water; freely in alcohol and ether. It should be kept reserved from light and air.

Dose, ½ to 2 fl. dr. 2 to 8 mils in capsules or a ixture (*see* p. 326).

ACTION.

External.– It is antiseptic.

Internal.—Large doses increase the flow of urin and somewhat strengthen the heart, but they do no affect the gastro-intestinal tract or respiratio enormous doses weaken the heart, and kill b paralysis of the respiratory centre.

Nervous system.—It is a **powerful hypnotic** without any unpleasant after-effects. It acts quickly, and the sleep, which lasts several hours, is quiet, refreshing, and dreamless. Paraldehyde in toxi doses paralyses the anterior cornua of the spina cord; thus it abolishes reflex action and cause paralysis. It does not affect nerves or muscles.

THERAPEUTICS.

It is given solely as an hypnotic in the same cla of cases as chloral, and as it does not act on th heart it may also be used for patients suffering from cardiac disease. It has been used largely in asylums to produce quiet in mania and sleep in melanchol. It may produce an erythematous rash. Unles given in capsules the great objection to its use is its nasty taste, which is best covered by syrup and tincture of orange peel with at least two fluid ounce of water to ensure a usual dose being dissolved. It gives its unpleasant odour to the breath, which lasts many hours. Its nasty taste usually prevents the formation of a paraldehyde habit, but occasionally this is contracted and the symptoms exactly resembl those of delirium tremens.

SULPHONAL.

Dimethyl-methane-diethylsulphone.

$C_7H_{16}S_2O_4$

SOURCE. It is a product of the oxidation of mercaptol

CHARACTERS. Colourless prismatic crystals, inodorous, almost tasteless. *Solubility.*—1 in 450 of cold, 1 in 15 of boiling water; 1 in 80 of alcohol (90 per cent.) or ether; 1 in 3 of chloroform.

Dose, 10 to 30 gr.—6 to 20 decigrms. in cachets or suspended in mucilage, or in flavoured boiling water, drunk as soon as cool enough.

ACTION AND THERAPEUTICS.

Sulphonal is an **hypnotic**. It does not depress the heart. The drug is given for the same class of cases as chloral hydrate, but as it is so insoluble it is absorbed with difficulty and slowly; hence it takes two or more hours to act, its action may be prolonged into the next day, and it is unsuitable for frequent use. It produces its effect most rapidly if the fluid in which it is suspended is hot, but as they are so much more convenient it is usually given in cachets an hour and a half before bedtime. Sulphonal rarely leads to a "sulphonal habit" or to any disagreeable after-effects. The symptoms of a sulphonal habit are general lethargy, mental, moral and muscular weakness, loss of nutrition, and dyspepsia. It has been known to produce eruptions on the skin and hæmatoporphyrin in the urine. Enormous single doses produce, in addition to these symptoms, prolonged sleep, lasting many days, paralysis of sphincters, anuria, a fall of temperature, and, late in the case, depression of respiration.

METHYLSULPHONAL.

Methylsulphonal. Diethyl sulphone-methyl ethyl-methane, $C_8H_{18}S_2O_4$. *Synonym.* Trional.

SOURCE.—It is an oxidation product resulting from the condensation of ethyl-methyl-ketone with ethyl-mercaptan.

CHARACTERS.—A white crystalline powder; slightly bitter. Almost insoluble in water and poorly in alcohol.

Dose, 10 to 20 gr.—6 to 12 decigrms. Best given in cachet.

ACTION AND THERAPEUTICS.

It is used for the same purposes as sulphonal, and like it may produce hæmatoporphyrinuria. As a rule it acts more quickly than sulphonal. It is rare for it to lead to the formation of a habit or to induce disagreeable after-effects, but its toxic symptoms are the same as those of sulphonal.

BARBITONUM.

Barbitone. $C_8H_{12}N_2O_3$. *Synonyms.* Diethyl barbituric acid; malonurea; diethyl malonyl urea; veronal, hypnogen.

SOURCE.—May be obtained by the interaction of th diethyl ester of malonic acid, and carbamide.

CHARACTERS.—A white crystalline powder. Inodorou Taste faintly bitter. Slightly soluble in cold water, more in hot and in alcohol, freely in aqueous alkaline solutions.

Dose, 5 to 10 gr. - 3 to 6 decigrms. Best in cachet or tablets.

ACTION AND THERAPEUTICS.

This is an hypnotic, inducing refreshing slee almost always without evil effects, but occasionall it causes a severe erythematous rash, and rarely an ordinary dose has produced dangerous and even fatal symptoms. It apparently acts on the central nervous system and does not depress the heart, and patients do not acquire the habit of taking it. Larg doses may be given to insane or delirious patients As with all insoluble hypnotics, sleep may be deferre till some time after giving the drug. **Medinal** (which is sodium veronal), dose 5 to 15 grains (3 to 10 decigrms.) dissolved in water, and **Adalin** (which is bromodiethyl-acetyl-urea), dose 5 to 15 grains (3 to 10 decigrms.) in a cachet, are both given as hypnotics. Often they are very useful.

Class V. **Drugs which have an Antipyretic or Analgesic Action.**

Acetanilidum, Phenazonum, Phenacetinum, Salipyrin, Citrophen, Pyramidon, Tolypyrin, Exalgin, Methylene Blue, Orthoform.

ACETANILIDUM.

Acetanilide. C_8H_9NO.

Synonyms. Antifebrin, Phenyl-acetamide.

Source. Glacial acetic acid and aniline are heated to ether. Acetanilide is distilled over and purified by crystallization.

Characters.—Colourless scaly crystals of a pungent taste. *Solubility.*—1 in 200 of cold water, 1 in 18 of boiling; 1 in 4 of alcohol (90 per cent.); freely in ether and chloroform.

Dose, 2 to 5 gr.—12 to 30 centigrms.—in cachets or suspended.

PHENAZONUM.

Phenazone. $C_{11}H_{12}N_2O$. *Synonyms.*—Antipyrine, Phenyl-dimethyl-isopyrazolone.

Source.—Aceto-acetic ether is acted on by phenyl-hydrazine, when phenyl-methyl isopyrazolone, ethyl alcohol, and water are formed. The monomethyl compound is heated with methyl iodide and methyl alcohol.

Characters. Colourless, odourless, scaly bitter crystals, freely soluble in water, alcohol, and chloroform.

Incompatibles.—It is incompatible with so many substances that it should be prescribed alone.

Dose, 5 to 15 gr.—3 to 10 decigrms.

PHENACETINUM.

Phenacetin. $C_{10}H_{13}NO_2$. *Synonym.* Para-acetophenetidin.

Source.—Glacial acetic acid is made to act upon paraphenetidin.

Characters. Colourless, tasteless, scaly crystals, very sparingly (1 in 1700) soluble in water. Soluble in 20 parts of alcohol (90 per cent.); insoluble in glycerin.

Dose, 5 to 15 gr. 3 to 10 decigrms.—in cachets, capsules, or suspended.

ACTIONS OF ACETANILIDE, PHENAZONE, AND PHENACETIN.

None of these substances has any action externally or on the gastro-intestinal tract. Acetanilide and phenazone are local hæmostatics, as they contract blood-vessels when applied to them. Acetanilide and phenacetin are in the body converted into para-amido-phenol and act as such. The change takes place the more rapidly with acetanilide and hence that is the more powerful and dangerous of the two.

Blood. With ordinary doses of these drugs this fluid is unaffected, but in large doses the colour is changed from the formation of methæmoglobin. The passage of this in the urine discolours it. Acetanilide causes the red corpuscles to break up, and arrests the movements of the white. We do not know for certain whether the other two substances can produce this result.

Heart. All these substances **depress the heart**, probably owing to a directly paralysing action on the cardiac muscle. This cardiac depression is much less marked with phenacetin than the other two, and is perhaps less with phenazone than acetanilide. Some persons, especially weakly women, are particularly susceptible, and the dangerous symptoms described under Toxicology may be easily produced in them.

Vessels.—Acetanilide and phenazone contract the smaller vessels from direct action on their muscular coat. The blood pressure therefore rises at first, but later it falls from the cardiac depression.

Respiration.—This is not affected by ordinary doses. After toxic doses the force of the respiratory act progressively diminishes.

Kidneys. Large doses of any of these drugs cause the urine to be dark from the passage of altered blood. Phenazone is quickly excreted as such combined with sulphuric acid in the urine. The other two often lead to the appearance of glycuronic acid in the urine.

Skin. Any of these three drugs may produce an erythematous rash which is usually measly or urticarial, and they are occasionally mild diaphoretics.

Temperature. These three substances are all powerful **antipyretics**. They have a very slight action on the temperature of health, but they reduce it very markedly when it is raised from any cause. They were all introduced into medicine for this property. We have already seen (*see* p. 72) how numerous are the ways in which antipyretics may act. The fall of temperature produced by these drugs is not due to any action on the blood or the circulation, and it is too marked to be entirely owing to their slight diaphoretic action. They all decrease heat production, and it is most likely that they act directly upon that part of the central nervous system, perhaps the corpora striata, which presides over heat production. They all increase heat dissipation. The result of these two actions is that the temperature falls. The proof of these statements is too long and complicated to give here, but we may mention that it is stated to have been shown both by a calorimeter, and by the decrease of the products of the febrile destruction of tissue, such as urea, that these drugs diminish heat production. Some differ from the above statement, and believe these drugs act only by dilating, by central action, the cutaneous vessels, and so increasing the heat loss.

Nervous system.—These three drugs are powerful **analgesics**. Acetanilide and phenazone in large doses are said to produce first convulsions, then coma and paralysis of motor nerves and muscles; but all these statements require further experiments.

THERAPEUTICS OF ACETANILIDE, PHENAZONE, AND PHENACETIN.

External. Acetanilide is occasionally employed as a dusting powder, or as an ointment (20 gr., 12 decigrms., to 1 oz., 32 grms.), for chronic ulcers and eczema.

Internal.—*Pyrexia.*—Originally these drugs were introduced into medicine on account of the property they have of reducing pyrexia. The opinion now is, however, that if the temperature is not dangerously high no attempt should be made to reduce it, for probably the raised temperature is an endeavour on the part of the body to defend itself against the micro-organisms which are the cause of the particular fever from which the patient is suffering; in other words, the pyrexia is a "defensive mechanism." Further, these drugs are all cardiac depressants and therefore unsuitable for patients suffering from fever, and this last consideration makes many physicians prefer to use cold water rather than these drugs when the temperature is so high that it is considered that it, in itself, is dangerous to life. Should it, however, for any reason be decided to give one of these drugs as an antipyretic, phenacetin has the great advantage of depressing the heart very little, and rarely producing the alarming toxic effects described below. It is, however, very insoluble, and slower and less powerful in its action than the other two, but the effect lasts longer. In order to gain a rapid effect, those who use these drugs commonly give either phenazone or acetanilide. Phenazone has the advantage of being soluble, and the balance of evidence is that toxic symptoms are more common after acetanilide, which, too, does not keep the temperature down quite so long as phenazone. Both take about two hours to reduce the pyrexia to its minimum, the last named being rather the more rapid of the two. Phenazone may be given subcutaneously, but this is not advisable, as sores may be produced. Either may be given *per rectum.*

Analgesic action.—All these drugs have the property of relieving pain. It is least marked with acetanilide, most with phenazone; but as phenacetin possesses it very strongly it is perhaps on the whole to be preferred as an analgesic, for toxic results after it are very rare. These drugs, especially phenazone, are largely used to relieve the pains of neuralgia, sciatica, dysmenorrhœa, locomotor ataxy, migraine, and various headaches. The dose of phenacetin for this purpose is 5 grains (3 decigrms.) every hour for three or four hours; this generally gives relief. Doses of 10 grains (6 decigrms.) of phenazone may be used for the same purpose. Useful preparations are Phenacetinum cum Caffeina Effervescens (B. P. C.), dose 60 to 120 gr. (4 to 8 grms.), and Pulvis Acetanilidi Compositus (B. P. C.), dose 3 to 5 gr. (2 to 3 decigrms.). Antikamnia, a proprietary drug, contains acetanilide 70 per cent., caffeine 10 per cent., and sodium bicarbonate 20 per cent. Antinervin contains acetanilide, sodium salicylate, and potassium bromide.

TOXICOLOGY.

All these drugs occasionally produce in man collapse, cyanosis, very slow respiration, a feeble and irregular pulse, vomiting, profuse sweating, and profound prostration. Many deaths have been caused by them. It has been stated that during one epidemic of influenza in Vienna seventeen persons were killed by phenazone. Acetanilide is most likely, and phenacetin least likely, to be accompanied by symptoms of poisoning. Any of these drugs may produce a rash, most often like measles or scarlet fever, but sometimes like pemphigus.

Treatment. Stimulation by alcohol and ether subcutaneously and by the mouth. Strychnine subcutaneously to stimulate the heart. Oxygen inhalations. Warmth to the feet and body.

Salipyrin (Not official), containing 42·3 per cent. phenazone and 57·7 per cent. of salicylic acid, has been us chiefly as an analgesic for chronic rheumatism and sciatic

Dose, 10 to 15 gr. - 6 to 10 decigrms.—in a cache or dissolved in alcohol.

Citrophen (Not official), a combination of citric ac and paraphenetidin (**Dose, 3 to 8 gr.** (**2 to 5 decigrms.** in water), has been used to relieve headache.

Pyramidon (Not official), an amido- derivative antipyrin (**Dose, 5 to 10 gr.** (3 to 6 decigrms.) in cachet), has been much used for headaches and neuralgia.

Tolypyrin (Not official) is antipyrin with one hyd gen atom of the phenyl group replaced by methyl. (**Dose. 5 to 20 gr.** (**3 to 12 decigrms.**) in a cachet.) It has be used for neuralgia.

Exalgin.—(Not official.)

Synonym. Methylacetanilide. $C_6H_5N(CH_3)CH_3CO$.

CHARACTERS.—Colourless acicular or tabular crystal with a slight saline taste. *Solubility.*—1 in 60 of wat freely in alcohol.

Dose, ½ to 3 gr. - 3 to 20 centigrms.

Exalgin is a powerful analgesic, and has been given wit uccess for neuralgia. Often it relieves when many othe drugs have failed. Medicinal doses rarely cause depressio but very large quantities may be dangerous, breaking up th blood like acetanilide. It is best dissolved in Tinctu Aurantii, and flavoured with Syrupus Aurantii Floris, bu may be made into a pill with syrup of glucose.

Methylene Blue. (Not official.)

Tetramethylthionine hydrochloride. An aniline derivativ

CHARACTERS.—Dull, dark green crystals forming an intensely blue solution in water. As commercial methylen blue contains zinc chloride, it must be ordered medically pure.

Dose, 1 to 4 gr. 6 to 25 centigrms.

It has been used as an analgesic in neuralgia, migrain sciatica, and rheumatism. Some authors recommend i strongly for malaria. It colours both urine and fæces a brilliant blue. Occasionally it causes cystitis.

Orthoform. (Not official.)

The methylester of meta-amidoparaoxybenzoic acid.

CHARACTERS.—A white crystalline powder with neither r smell, and very slightly soluble in water.

It is non-poisonous, and has no action on healthy skin mucous membranes, but applied to abraded surfaces, as a powder or ointment (10 to 20 per cent. with r is a powerful local anæsthetic, and is of great use ve the pain of cancer, ulcers, and burns. It is often applied to the larynx, and in doses of 1 to 3 gr. 20 centigrms.) it relieves the pain of cancer of the ach.

CLASS VI.—Antiseptics.

Carbolic **Acid, Picric Acid, Resorcin, Creosote, Guaiacol, Iodoform, Naphthol, Cresol, Creolin, Cyllin, Chinosol, Atophan, Lysol, Izal, Ialine, Formaldehyde, and Hexamine.**

ACIDUM CARBOLICUM.

Carbolic Acid. Phenol, or Phenyl alcohol. C_6H_6O.

SOURCE.—From coal-tar oil by fractional distillation, and rification.

CHARACTERS.—Colourless deliquescent crystals of a iar odour. Taste sweetish, pungent. Treated with t 6 per cent. of water, they become fluid: they are very scopic, and hence soon become semi-fluid on exposure to Often reddish from the impurities aurin and rosolic acid, h form a red compound by the absorption of carbonic l and oxygen. Melts at 40°C. to an oily liquid. Does not den litmus paper, coagulates albumen. *Solubility.*—1 in of water; freely in alcohol, fats, and oils.

It is contained in Injectio Ergotæ Hypodermica

Dose, 1 to 3 gr. (6 to 20 centigrms.) as a pill. The mass is best made thus: Acidum Carbolicum, 60 gr.; rd paraffin, 12 gr.; wheaten flour, 45 gr.; tragacanth, 3 gr.

Preparations.

1. **Acidum Carbolicum Liquefactum.** Phenol, 100; water, to produce 115.
   Dose, 1 to 3 m.—6 to 18 centimils.
2. **Glycerinum Acidi Carbolici.** Phenol, 1; glycerin, 5.

3. Suppositoria Acidi Carbolici.—1 gr. (0·06 grms.) in each. Made with white beeswax and oil o theobroma.

4. Trochiscus Acidi Carbolici. Phenol, 15 ; refined sugar, 500 ; gum acacia, 45 ; tragacanth, 15 ; lemon juice, 45. A simple basis.

Each lozenge contains 0·03 grm. of Phenol approximately ½ gr. It is one-half the strength of th corresponding preparation B. P. 1898.

5. Unguentum Acidi Carbolici. Phenol, 3 white paraffin ointment, 97.

ACTION.

External. Carbolic acid, being a protoplasmic poison, is a powerful **antizymotic,** rapidly destroying organized ferments, both animal and vegetable. Consequently it destroys those of septic diseases, hence it is **antiseptic.** It thus prevents the formation of the products of the decompositions which are set up by these organisms. For this reason it is **disinfectant,** and as these products of decomposition are generally foul-smelling, it is **deodorant.** It does not act so readily on unorganized ferments (enzymes), such as pepsin and ptyalin, but in large doses it likewise destroys their activity. Carbolic acid is not so powerful an antizymotic as perchloride of mercury (*see* p. 211) ; for Evans ('Guy's Hospital Reports,' vol. xlvii.) found that anthrax spores were not killed in twenty-four hours by a solution of 1 in 100, but were killed by a solution of 1 in 20 acting for twenty-four hours, but not when it acted for only four hours. The bacilli of anthrax were killed by solution of 1 in 100 acting for five minutes, 1 in 150 acting for a quarter of an hour, 1 in 175 acting for half an hour, but were unaffected by a solution of 1 in 150 acting for one minute, 1 in 175 acting for a quarter of an hour, 1 in 300 acting for an hour. Strengths of 1 in 40 and 1 in 20 are commonly employed in surgery. The solution in oil has no antiseptic properties. The power of carbolic acid to destroy low organisms makes it an efficient **parasiticide** against certain vegetable parasites infesting the skin.

When applied to the skin in weak or moderately strong solutions, it produces **local anæsthesia** with a feeling of numbness, which lasts some hours. If concentrated it acts as an **irritant** and **caustic**, causing a burning pain, and in a few minutes a white spot appears, which becomes red when the acid is removed. If the application is prolonged a white char or slough results. There is no vesication.

Internal. *Gastro-intestinal tract.* If concentrated, carbolic acid produces the same effect on the mouth as on the skin, and is a powerful gastro-intestinal irritant (*see* Toxicology). In the stomach it is converted into a sulphocarbolate, and unless poisonous doses be given, it is so diluted by the gastric contents that it loses its antizymotic power.

Blood.—It is not known in what form carbolic acid circulates.

Circulation. Medicinal doses have no effect. Large doses paralyse the vaso-motor centre in the medulla, and the blood-pressure falls. It is not until very large doses have been given that the heart is affected, and then its activity is depressed.

Respiration.—Small doses have no influence on respiration, but large ones accelerate it, probably from stimulation of the vagi. Ultimately respiration is paralysed, and death results.

Temperature.—This is unaffected by small doses of carbolic acid, but large doses cause it to fall, because they diminish the production of heat and increase its dissipation.

Nervous system.—Carbolic acid is a cerebral depressant in large doses, for coma is produced by them; they first stimulate the anterior cornua, producing convulsions, but subsequently depress them, causing paralysis.

Urine.—Much interest attaches to this, for even after moderate doses of carbolic acid, or absorption from surgical dressings, **the urine may become dark,** especially on being kept exposed to air. This is not due to blood, as was once thought, for Sir Thomas Stevenson has shown that there is no increase of iron in the urine. After taking carbolic acid, salts of phenyl sulphuric acid and glycuronic acid, pyrocatechin and hydroquinone appear in the urine. The last two are oxidation products of carbolic acid, which on further oxidation produce dark-coloured substances, which are the cause of the colour of the urine. The presence in the urine of thes results of carbolic acid is recognized by distilling them over from it after acidifying with sulphuric acid. The distillate gives a blue colour with neutral ferric chloride, a white crystalline precipitate of tribromophenol with bromine water, and a red colour on heating with Millon's reagent. Some carbolic acid escapes in the other excretions; some is burnt up in the body When very large doses are given, carbolic acid itsel may appear in the urine in the free state.

THERAPEUTICS.

External.—Carbolic acid is largely used as deodorant and disinfectant for drains, bed-pans (fo which the cheap crude acid may be employed), soile linen, surgical instruments, the surgeon's hands, &c Carbolic lotion (1 in 40) is used to wash wounds t keep them antiseptic, and carbolized gauze (which unbleached cotton gauze medicated with half i weight of a mixture of carbolic acid 1, resin paraffin 4) is employed as a dressing for the san purpose. Carbolized gauze and carbolized lint are al prepared. A spray of a solution of carbolic acid was formerly much used to keep the air round the wound antiseptic during an operation, but it is now discarded as unnecessary.

Glycerin of carbolic acid is a very efficient preparation to destroy the fungus of tinea tonsurans or tinea versicolor; for the latter it should be diluted.

Because of its anæsthetic effect a strong solution (1 in 20) will relieve itching from any cause. Carbolized vapour has been inhaled in phthisis, but by the time it reaches the lungs it is far too dilute to have any action on the tubercle bacilli.

Internal. *Mouth.*—The glycerinum, if diluted, may be applied as a stimulant to the mouth in aphthous stomatitis, or when any indolent ulceration is present. A gargle (15 ♏, 1 mil, of Glycerinum Acidi Carbolici to 1 fl. oz., 30 mils, of water) is an excellent preparation. The glycerinum has been used for diphtheria, but probably it does no good, except that being a local anæsthetic it soothes pain. A piece of cotton wool soaked in strong carbolic acid will relieve pain if placed in a decayed tooth, but care must be taken to prevent it from coming in contact with the soft parts, by putting another piece of dry cotton wool over it.

Stomach.—Carbolic acid has been given to relieve flatulence, because it was thought that it would prevent decomposition in the stomach; but it is powerless to do this, owing to the degree to which the gastric contents dilute it. Some state that it checks vomiting and helps to cure dyspepsia, but it is not a remedy which is universally regarded as useful for these purposes. It may, however, be tried in obstinate cases, and it will sometimes be found to be a good carminative. Carbolic acid has been given internally as an antiseptic in phthisis, but it does no good, and those who give it forget that probably very little carbolic acid reaches the lungs.

It has also been extensively tried in typhoid feve but without any good effect.

TOXICOLOGY.

If carbolic acid is at all concentrated, immediately o swallowing it there is an intense burning sensation in th mouth, gullet, and stomach, and white eschars form in th mouth. The patient is collapsed, his skin is cold and clamm The breathing becomes more and more feeble and shallo and finally stops. The urine is darkish green. Reflex mov ments are abolished, and ultimately he becomes insensib and comatose. *Post mortem.*—There are white, hard slough with perhaps inflammatory redness round them, in the mout œsophagus, and stomach. The blood is dark and coagulat imperfectly. In some cases fatty degeneration of the liv and kidneys may be found

Treatment.—Any soluble sulphate, such as an ounce magnesium sulphate or half an ounce of sodium sulpha dissolved in half a pint of water, is the natural antido because sulphates and carbolic acid form sulphocarbolates the blood, and these are harmless. Chalk and saccharat lime are excellent antidotes. Before the antidote is giv wash out the stomach, or use some very quickly act emetic, as apomorphine given hypodermically. Give stim lants freely, such as ether or brandy subcutaneously. Ap hot-water bottles and blankets if there are any signs collapse.

PHENOLPHTHALEIN.

Phenolphthaleinum. $C_{20}H_{14}O_4$. *Synonym* Dihydroxy-diphenyl-phthalide. Purgen. Laxoin. Laxat

SOURCE.—Obtained by heating phenol with phtha nhydride and sulphuric acid.

CHARACTERS.—A white or yellowish white crystallin amorphous powder. Odourless and tasteless. Almost soluble in water. Soluble in alcohol.

Dose. 2 to 5 gr. 12 to 30 centigrms. Best giv in cachets or lozenges.

ACTION AND THERAPEUTICS.

An excellent purgative acting directly on intestinal mucous membrane. It does not gri and, being tasteless, is suitable for children.

sets in about six hours, and may therefore be given at bedtime. Very little is absorbed, and the fæces turn a brilliant purple when an alkali is added to them. As it is not depressant it is useful for cases of heart disease.

ACIDUM PICRICUM.

Picric Acid. $C_6H_2(NO_2)_3OH$. *Synonyms.* Car[illegible]c acid. Trinitro-phenol.

SOURCE.—May be obtained by the action of nitric acid [illegible] phenol.

CHARACTERS. Bright yellow crystalline powder. In taste, very bitter. Soluble in 90 parts of water and 10 of alcohol, forming intensely yellow solutions which stain the [illegible] yellow.

ACTION AND THERAPEUTICS.

Externally it is a powerful antiseptic, and a one per cent. solution has been used for burns. Being a gastro intestinal irritant it is not suitable for internal administration. It is used for the determination of albumen in the urine (Esbach's test).

RESORCIN.

Resorcin.—$C_6H_6O_2$. *Synonyms.* Meta dihydroxybenzene. Resorcinol.

SOURCE. Obtained by the interaction of fused sodium hydroxide and sodium metabenzene-disulphonate.

CHARACTERS.—Colourless, shining acicular or prismatic crystals. Faint odour. Taste pungent sweet followed by bitterness. *Solubility.* 1 in 1 of water or alcohol. Freely [illegible] olive oil, ether, or glycerin.

Dose, 1 to 5 gr. 6 to 30 centigrms.

ACTION AND THERAPEUTICS.

This substance, originally introduced as an antiseptic, is now rarely given internally, as it is too depressant to the heart. A solution of resorcin in glycerin, 1 in 4, is excellent for removing epidermic scales in chronic skin diseases, and also for getting rid of the scurf in seborrhœa sicca of the scal A lotion: Resorcin 1, ether 1, castor oil 1, eau Cologne 10, alcohol (90 per cent.) 35, is useful f dandriff and alopecia. Resorcin is a powerful an sepic, and a 5 per cent. solution may be inject into the bladder in cystitis.

CREOSOTUM.

Creosote.

Source. It is obtained by the distillation of beech It consists chiefly of a mixture in variable proportions guaiacol ($C_7H_8O_2$), creosol ($C_8H_{10}O_2$), and less of other phen

Characters.—A colourless or slightly yellow liquid, w a very strong peculiar odour and a burning taste S *bility.*—1 in 150 in water, freely in alcohol, ether, and glac acetic acid.

Impurity. Carbolic acid.

Incompatible.—Explodes when mixed with oxide silver.

Dose, 1 to 5 m. 6 to 30 centimils suspended mucilage; or as a pill thus, creosote 10 m, melted y wax 15 gr., powdered curd soap 35 gr. to make 10 pill (diluted with three times the quantity of almond oil) capsules.

Preparation.

Unguentum Creosoti. — Creosote, 1; h paraffin, 4; white soft paraffin, 5.

Action and Therapeutics.

Creosote has the same actions as carbolic ac and before that was introduced creosote was u externally as a stimulating antiseptic, a parasitic and a slight local anæsthetic: and internally it w given for vomiting and for flatulence. It h been much employed in phthisis, and a few auth claim considerable success. The dose must be gr ally pushed until from 30 m to 60 m (2 to 4 m are taken at a time. It should be given immediat after meals. The taste may be concealed by putt a few drops in a teaspoonful of rum, but it is b [illegible] in capsules. The carbonate, called creosotal (the dose given after meals in capsules), is said to be [illegible] liable to cause indigestion. Creosote has also been used as an inhalation with a steam atomizer. Air drawn through 30 ♏ (2 mils) mixed with a pint of water at 140°F. (60°C.) may be inhaled. Bronchiectasis with foul sputum is much benefited by the patient stay an hour or two a day in a small room in which creosote is being volatilized. An aching tooth may be relieved if it is plugged with cotton wool soaked in creosote.

GUAIACOL.

Guaiacol. $C_7H_8O_2$.

SOURCE.—May be prepared synthetically or obtained by fractional distillation of beech tar creosote.

CHARACTERS.—A colourless liquid, or colourless crystals melting at about 28° C. Faint odour; taste caustic, pungent. Soluble in 80 parts of water, freely in alcohol.

Dose 1 to 5 m. 6 to 30 centimils. Best given in [illegible] diluted with three times the quantity of almond oil; or dissolved in cod-liver oil or sherry.

Guaiacol Carbonate. The carbonic ester of guaiacol $(C_7H_7O_2)_2CO$.

SOURCE.—Obtained by the interaction of carbonyl chloride with sodium guaiacolate.

CHARACTERS.—A white crystalline powder, inodorous, almost tasteless. Insoluble in water, sparingly in alcohol.

Dose, 5 to 15 gr.—3 to 10 decigrms. Best given in cachet.

ACTION AND THERAPEUTICS.

External.—Guaiacol is antiseptic. If painted over an area of 4 to 20 square inches of skin, it reduces pyrexia, but is not used for this purpose as it causes sweating and collapse.

Internal.—It has been much given in phthisis, for it is believed to aid the destruction of the bacilli in the lungs, but although widely used there

is no certain evidence that it is beneficial. Th
carbonate and the benzoate (dose of either, 5 to 10
3 to 6 decigrms., in a cachet) have also been give
They are said to have the same effects as guaiac
and they do not upset the stomach. **Chronic oste
arthritis** has been treated by giving guaiacol carbona
with a little potassium iodide in a cachet. It is
favourite remedy with many prescribers. Styrac
(a guaiacol cinnamic ester) is said to be a go
preparation combining the advantages of guaiac
and cinnamic acid (*q.v.*), which is an intestin
antiseptic

IODOFORMUM.

Iodoform. CHI_3.

SOURCE.—Obtained by the action of iodine on ethy
alcohol in the presence of a solution of potassium carbonat

CHARACTERS.—Small, lustrous, lemon coloured hexago
crystals. Has an odour like seaweed. Slightly soluble
water and alcohol, freely in fixed and volatile oils, ether, a
chloroform. It contains 96·7 per cent. of iodine.

Dose, ½ to 3 gr. 3 to 20 centigrms.

Preparations.

1. **Suppositoria Iodoformi.** — Iodofor
2·4 grms.; oil of theobroma, q.s. to make twel
Each contains 0·2 grm. (about 3 gr.) of iodoform.

2. **Unguentum Iodoformi.** – Iodoform.
prepared lard, 9. In India prepared suet should
used instead of prepared lard.

ACTION.

External. Iodoform is **antiseptic and dis
fectant**, if we may judge by the results obtain
in clinical practice; but the experimental eviden
that it has no power to hinder the development
Staphylococcus pyogenes, *Bacillus subtilis*, and oth
micro-organisms is very strong, for all except one
two experimenters state that it has not any antisep

properties. The reason of these discrepancies is probably this: Iodoform only acts as an antiseptic after its decomposition, which results in the liberation of free iodine. The fats always present in tissues dissolve it. When dissolved it is easily decomposed by many agents, such as light, oxygen, living cells, and ptomaines, which would have no effect on it if it were undissolved. By one or more of these it is, when dissolved after being dusted on a wound, slowly decomposed. Iodine is thus set free rapidly enough to act as an antiseptic, but not rapidly enough to act as an irritant.

Internal.—Not much is known about the internal action of iodoform. It is eliminated in all the secretions, but chiefly in the urine, as iodine, iodides, and iodates. They may be found in the urine for three days after administration of iodoform.

THERAPEUTICS.

External.—Iodoform is much used as a local stimulant, antiseptic, and disinfectant. The clinical testimony to its value is overwhelming.

Its anæsthetic influence diminishes the pain, if there is any, of the sores to which it is applied. It is an excellent application for all sorts of ulcers, sores, and wounds, but especially for tuberculous and syphilitic ulcerations and chancres. Powdered iodoform is usually sprinkled on them. Wounds and venereal sores are often painted with a solution of it in collodion (1 in 12 of flexible collodion). This is an excellent application. Iodoform is useful as an insufflation (iodoform 1, starch 2) for ozæna, ulcers of the mouth and throat, and tuberculous ulcers of the larynx. Often $\frac{1}{3}$ gr. (21 milligrms.) of acetate of morphine is added. An emulsion (iodoform 1, moistened with alcohol; boiling water 2, glycerin 7) is very useful for injection into sinuses or abscess cavities. It has been used in the form of a bougie for the urethra and for the nose. The suppository useful in painful conditions of the rectum. It occasionally employed for pruritus, and to relieve t pain of neuralgia. Many attempts have been ma to get rid of its odour; balsam of Peru, musk, a 2 per cent. of creolin have been used, but oil geranium (1 to 25) is best.

Internal.- Iodoform has not been found to of any use internally. It has been tried unsucce fully in phthisis and many other conditions.

TOXICOLOGY.

Curious symptoms, often severe and sometimes e in death, are occasionally observed after the applicati iodoform to a raw surface They are a quick pulse, gas intestinal irritation, fever, rapid collapse, melanchol lucinations, dilated pupil, extensive erythema, and perh eczema. These symptoms vary much in severity, a rare for more than two or three of them to be present It is not known how iodoform causes them. The symptoms are the most characteristic. Fatty degenerat the liver and muscles may occur. Stimulants, diaph and sponging the skin with warm water are recommended.

Iodoform-like Substances. (Not offic There are many of these in the market. They depend for their antiseptic properties on the iodine in th They have no advantage over iodoform, except that some them have no odour. The following are the chief:

Iodoform	contains	96·7	per cent. of iodine
Iodol	,,	90·0	.. .. ..
Losophan	,,	80·0	.. .. ..
Di-iodo-salicylic acid		66·0	,, ...
Sozoiodol	contains	54·0	.. .. ..
Iodo-salicylic acid		50·0	.. ,, ..
Aristol	contains	46·0	.. .. ..
Europhen	,,	28·0	.. .. ..

NAPHTHOL.

Beta-naphthol or Beta-mono-hydroxy-naphthalene. C

SOURCE. Prepared from naphthalene-sulphonic a

CHARACTERS AND TESTS. White shining laminar cry or in powder. Odour like phenol, taste pungent. *Solu* [illegible]ly in alcohol, ether, chloroform, benzene, 1 in 1000 cold [illegible]ter, 1 in 8 of olive oil, [illegible] 80 of vaseline.

Dose, 3 to 10 gr. [illegible] **3 decigrms.**—in a cachet.

ACTION AND THERAPEUTICS.

A powerful antiseptic. A 10 per cent. ointment [illegible] scabies, and stronger may be used for ringworm. [illegible] has been used for psoriasis. It is given as an intestinal antiseptic in typhoid fever and infantile diarrhœa, but it is difficult to say how far any improvement which follows is due to rest or dieting, and [illegible] possible that, as micro-organisms play a part in healthy digestion, a really efficient intestinal antiseptic might do more harm than good. It is useful [illegible] dilated stomach. Used for long periods it may [illegible] nephritis. Large doses cause symptoms like [illegible]se due to carbolic acid.

Scarlet Red.—(Not official.)

[illegible]-azo-toluene tetranaphthol. A red powder soluble [illegible] and fats. An excellent stimulating ointment (4 to [illegible] cent. with a lard basis). The dressing should be [illegible]d night and morning.

Naphthalene.—(Not official.) $C_{10}H_8$.

Synonym.—Naphthalin, Tar Camphor.

Dose, 3 to 12 gr. 2 to 8 decigrms.—in a cachet.

It is an antiseptic and is much used instead of camphor [illegible] the ravages of moth in furs, &c. Internally it [illegible] for the same purposes as naphthol and as an [illegible]mintic for tape and round worms.

CRESOL.

Cresol. A mixture of isomers of the formula $C\ H\ OH$ [illegible]d from coal tar. Should be preserved in stoppered [illegible]coloured bottles.

Synonym.—Cresylic acid.

CHARACTERS.—A straw-coloured liquid, becoming brown [illegible] or on exposure to light. Soluble in 50 parts of [illegible]

Dose, 1 to 3 m.—6 to 18 centimils.

Preparation.

Liquor Cresol Saponatus. (Cresol, 50; castor [illegible] 35; potassium hydroxide, 8; distilled water, 100.

Action.

It is a more powerful antiseptic than carbol acid. It is excreted in the urine as cresyl-sulphon acid.

Therapeutics.

It is used in surgery and generally as an an septic, and may with advantage replace carbolic ac in many lotions and ointments as it is less poisono and less caustic. It may be given internally w olive oil in capsules as a gastro-intestinal disinfectan It often benefits whooping-cough if volatilized in t sick room. The following substances: creolin, cyll chinosol, atophan, lysol, izal, taline, kerol, are wid used and are very similar to cresol. Cresol and allies being so common have led to many cas poisoning. The symptoms are like those of carbo acid poisoning. The stomach should be immediat washed out and then white of egg or olive oil sh be given to prevent the re-absorption of any of t poison excreted into the stomach. Treatment m be prompt and general stimulants will be required.

Creolin.—(Not official.)

This is a dark yellow liquid derived from coal tar. I a mixture of cresols. Jeyes' disinfectant and other prepa tions contain it. It is a powerful germicide. It forms a wh emulsion with water, is cheap and has a pleasant smell. T symptoms are known, but are very rare.

Cyllin.—(Not official.)

A dark liquid coal-tar derivative strongly antiseptic. is purified creolin. It forms a white emulsion with wa and a lotion (1 in 200) is often used. It is one of the b intestinal disinfectants, and capsules containing 2 or 3 m 18 centimils) for an adult are given for colitis, summ diarrhœa, dysentery, and similar diseases. It may be flavoured with syrup and suspended, but the taste is nast

Chinosol.—(Not official.)

The potassium salt of a compound of oxychinoline sulphuric acid. A coal-tar derivative. Used as a antiseptic; 15 grains to the pint equal 1 in 40 of carbolic a

Atophan.—(Not official.)

A substance allied to chinosol: said to increase the output of uric acid in the urine. Dose 10 to 20 gr. (6 to 12 decigrms.) in a cachet.

Lysol and **Izal.**—(Neither official.)

These coal-tar derivatives are powerful antiseptics, are not highly poisonous, and are, when mixed with water (Lysol 2 per cent., Izal ½ per cent.), used in surgery. Lysol is very popular. It does not affect instruments, but may make them difficult to hold, as it is a solution of tar oils in a neutral soap.

Ialine.—(Not official.)

A powerful antiseptic containing 50 per cent. cresol. May be used as a surgical and general antiseptic for precisely the same purposes as Lysol. It is an entirely British product.

Kerol.—(Not official.)

A coal-tar derivative of high antiseptic power suitable for the same uses as other antiseptics. Capsules containing 3 m are employed as intestinal disinfectants.

FORMALDEHYDE (Not official.)

1. Liquor Formaldehydi (Official). *Synonym.* Formalin. An aqueous solution containing in 100 millilitres not less than 36 and not more than 38 grammes of formaldehyde, CH$_2$O. This may be obtained by the limited oxidation of methyl alcohol.

Characters.—A colourless liquid with a characteristic, pungent odour. Miscible with water and alcohol in all proportions. Caustic when applied to the skin.

2. Liquor Formaldehydi Saponatus.—(Official.)—Soft soap, 40; alcohol (90 per cent.), 30; solution of formaldehyde, 20; distilled water to 100.

Action and Therapeutics.

Formaldehyde vapour when inhaled is very irritating to the air-passages, and causes violent sneezing. Formalin is powerfully caustic; diluted with ten times its bulk of water it is used for corns, and is a good preservative for museum specimens, which do not shrink in it. Diluted twenty-five times it is used as a histological hardening agent. It is an excellent germicide, and has been employed (30 per cent.) with good results for ringworm of the scalp.

It is not much used in surgery as it retards healing, but it is a most powerful disinfectant and does n destroy coloured fabrics. It is believed to act i virtue of its power of combining with proteins. two per cent. solution may be used. Formalin water 500, is an admirable wash for a foul mout Tablets called formamint tablets, of which th principal ingredient is formaldehyde, are much use for disinfection of the mouth.

Paraform (a white amorphous substance and polymer of formaldehyde) on being heated by a enclosed spirit lamp sublimes, and, combining wi the products of combustion, is converted into th vapour of formaldehyde. This has been recommende as a disinfectant for sick rooms after illness. Ka thack has shown that at least two Formogène Richa lamps should be used, and that only surfaces are di infected, for the vapour did not penetrate thin duste

Lysoform (a liquid formaldehyde potash soap is a powerful antiseptic, inodorous and miscible wi water. A 2 per cent. solution is used for ma disinfectant and surgical purposes. A mouth wa tooth powder, and soap are employed.

HEXAMINE.

Hexamina. Contains not less than 98 per cent pure hexamethylene tetramine, $C_6H_{12}N_4$.

Synonyms. Urotropine, cystamin, hexamethyl tetramine.

SOURCE. Obtained by the interaction of ammonia w formic aldehyde.

CHARACTERS.—Colourless crystals or crystalline pow Inodorous. Taste at first sweetish, bitter afterwa Soluble in 1·5 parts of water and in 8 of alcohol (90 per cen

Dose, 5 to 15 gr. 3 to 10 decigrms.

ACTION AND THERAPEUTICS.

Hexamine is the most powerful urinary an septic we have; it acts by the formation of fo aldehyde in the urine, in proportion as this is a therefore acid phosphate of sodium should be gi with urotropine. It is very useful for keeping the urine sweet in cases of cystitis; also, it is useful for bacilluria, for the nocturnal incontinence of children when that is due to bacillus coli in the urine, and to disinfect the urine when typhoid bacilli are excreted in it. Occasionally it causes a measly rash accompanied by much itching, rarely it causes hæmaturia. It is slightly diuretic. Outside the body solutions of it dissolve uric acid, but there is no evidence that the administration of it increases the solubility of uric acid in the urine. Helmitol and Hetraline, both soluble in water; dose of each, 5 to 10 gr., 3 to 6 decigrms., are bodies of a similar constitution and action.

CLASS VII. **The Remaining Carbon Compounds.**

These have no relationship to each other, and each must therefore be considered separately.

ACIDUM HYDROCYANICUM DILUTUM.

Diluted Hydrocyanic Acid. Hydrogen Cyanide.

Synonym. Dilute Prussic acid.

SOURCE.—Prepared by the interaction of potassium ferrocyanide and sulphuric acid. It is a 2 per cent. by weight solution of hydrogen cyanide, HCN. Scheele's prussic acid is a 4 or 5 per cent. solution.

CHARACTERS.—A colourless, volatile, faintly acid liquid, having an almond-like odour. Very unstable; to preserve it, it should be kept in a dark place in small inverted amber-red stoppered bottles. Old specimens may be inert. Sp. gr. 0·997. *Strength.*—2 per cent.

INCOMPATIBLES. Salts of silver, copper, and iron, red oxide of mercury, and sulphides.

IMPURITIES.—Sulphuric and hydrochloric acids.

Dose, 2 to 5 m.—12 to 30 centimils.

Preparation.

Tinctura Chloroformi et Morphinæ Composita ½ m of Acidum Hydrocyanicum Dilutum in 10 m, *i.e.* 5 per cent. (*See* p. 297.)

Dose, 5 to 15 m. 3 to 10 decimils.

Hydrocyanic acid is contained in Aqua Laurocerasi, and in the oil of bitter almonds (non-official). It is probably the active ingredient of the preparations of Virginian Prune.

ACTION.

External. Hydrocyanic acid can pass throug the epidermis, and then it paralyses the termination of the sensory nerves; thus it is a **local anæstheti and sedative.** It is very rapidly absorbed from rav surfaces, and may cause poisoning if applied to then

Internal. *Alimentary tract.* It is quickly absorbed by mucous membranes, and has the sam anæsthetic and sedative effect on the mouth an stomach as on the skin. It must always b employed very dilute. A single drop of the pur acid placed inside the eye of even a moderately larg animal will kill it instantly.

Blood. If death takes place almost immediatel after the administration of the drug, all the bloo in the body is of a bright arterial tint; but if deat does not occur for some little time (within half a hour), the blood is of a dark venous colour. Th primary transitory reddening of the venous bloo is due to the fact that the hæmoglobin in it is sti oxidized, because prussic acid retards the absorptio of oxygen by the tissues, so lowering metabolism. Th subsequent darkening of the arterial blood is due t the fact that it has lost its oxygen, and contain carbonic acid gas; why this should be is no certain, but probably it depends upon the asphyx consequent upon the action of hydrocyanic acid o the respiratory centre. If blood be shaken up wit prussic acid, after some time oxyhæmoglobin converted into cyanohæmatin, the oxygen bein turned out. Prussic acid added to drawn bloo alters the shape of the red blood-corpuscles. Neithe of these actions is seen in life, for sufficient pruss acid to cause them would kill before they coul take place. Lactic acid and sugar are found in th urine if much prussic acid has been taken. The are usually present when from any cause oxidatio of tissues is imperfect.

Heart.—Large doses cause instantaneous **diastolic arrest**. As this is also true if the drug is applied locally, we may conclude that large doses paralyse the heart directly. But prussic acid acts also on the cardiac centre in the medulla. A small dose will cause a slowing of the pulse from stimulation of the vagus centre, and the stoppage from larger doses is due both to the direct action on the heart and to that on the medulla.

Vaso-motor system.—The vaso-motor centre in the medulla is first briefly stimulated, and the blood-pressure rises, but soon it is profoundly **paralysed**; blood-pressure therefore falls **very low**.

Respiration. The respiratory centre is **paralysed** even more readily than the cardiac or vaso-motor centres, consequently the respirations quickly diminish both in force and frequency. Unless the heart has been instantaneously stopped by a large dose, asphyxia is the cause of death, and the heart goes on beating after the respirations have stopped. If the dose be quite small, all three centres may be at first transitorily stimulated, so that the pulse and respirations may be increased in frequency, and blood-pressure may rise.

Nervous system.—*Cerebrum.*—Medicinal doses of prussic acid have no effect on the cerebrum. Toxic doses cause deep insensibility and coma. In man convulsions are rarely seen; in animals they are common. It is probable that the coma and convulsions are due to the direct effect on the brain, but they may in part be due to the altered circulation through it, or to the asphyxia

Peripheral nerves and muscles.—In animals dead of prussic acid poisoning these are unexcitable. The paralysing effect is due to a direct action on the nerves and muscles themselves, for it does not occur in the peripheral part of a limb if it is connected with the rest of the body only by its nerve.

In this case, as no blood is circulating through t distal part of the limb, no prussic acid reaches but if the acid be applied locally to the severed lim the nerve and muscles are paralysed. This explai the local anæsthetic effect of prussic acid.

Shortly before death the spinal cord is pa lysed. The pupil is dilated.

Kidneys. We do not know of any effect of prus acid on the kidneys. Part of it is excreted as sulphocyanide. It slightly reduces the temperatu

THERAPEUTICS.

External. Lotions of a strength of about 10 (6 decimils) of the diluted acid to 1 fl. oz. (30 mi of water are valuable for allaying itching due to a cause. If the skin is abraded they must not used.

Internal. Small doses, 2 to 4 ♏ (12 to 25 cen mils) of the diluted acid, are used for their sedati effect on the nerves of the stomach, to allay vomitin and to relieve gastric pain, whatever may be the cause, and often with good effect. A useful way giving it is in an effervescing draught. It is common ingredient of cough mixtures, for by i depressing effect on the central nervous system diminishes reflex excitability, and is consequent most serviceable for a dry hacking cough, by mea of which nothing is expectorated.

TOXICOLOGY.

With a large dose the symptoms usually begin in a seconds; it is rare for them to be delayed more than two mi The patient is perfectly insensible, the eyes are fixed glistening, the pupils dilated, the limbs flaccid, the ski and clammy. The respiration is slow, deep, and convu the pulse is almost imperceptible. *Post mortem.* Ther be an odour of prussic acid about the body, which livid. The fingers are clenched, the jaws firmly closed. there is froth at the mouth; the eyes are fixed and glist and the pupils are dilated. The stomach may be a little reddened. The blood is very dark.

Treatment. Wash out the stomach immediately. If antidotes are available large doses must be given very promptly, as every moment is important. Give ether or brandy and [illegible] gr. of atropine subcutaneously. Use inhalations of ammonia and artificial respiration.

GLUSIDUM.

Gluside. Benzosulphinide $C_7H_5NSO_3$.

Synonyms. Glucusimide. Saccharin.

Source.—It is the anhydride of orthosulphamido-benzoic acid derived from toluene by a complicated process.

Characters. A light, white, minute crystalline powder. Its solution has an intensely sweet taste; 1 of saccharin is equal to 300 of cane sugar. *Solubility.* 1 in 400 of cold water; 1 in 24 of boiling water; 1 in 500 of chloroform; 1 in 25 of alcohol (90 per cent.); 1 in 48 of glycerin. It unites with alkaline hydrates and carbonates, evolving from the latter carbonic acid gas, and yielding soluble saccharin, which has lost none of its sweetness, and is very soluble in water.

Impurities. Commercial saccharin is not a pure or uniform product: it often contains less than 50 per cent. of actual glusidum.

Action and Therapeutics.

Glusidum is an antiseptic, but is not used as such. It is employed as a **sweetening agent** when from any cause, as diabetes, sugar cannot be taken. It may be given as tablets or with sodium carbonate to form soluble saccharin. Elixir Glusidi (B.P.C.) containing glusidum, sodium bicarbonate, alcohol (90 per cent.) and distilled water is excellent for covering the taste of nauseous medicines. Usually 20 ♏ (12 decimils) are required for a four-ounce mixture.

PARAFFINUM LIQUIDUM.

Liquid Paraffin.

Liquid paraffin is a mixture of liquid hydrocarbons.

Characters.—A transparent colourless, odourless, taste- clear oily liquid. Sp. gr 0·860 to 0·890.

USES.

It is unabsorbed from the alimentary canal, b is an excellent aperient for many persons, producin if taken over-night an easy motion of the bow without any griping. With some it has little acti and in others it may pass through the bowels a out of the anus without bringing any motion with Then the patient may be unaware that the paraff is passed. It is a popular aperient with those wh it suits and may be taken for a long period. T usual dose is ½ to 1 fl. oz. (15 to 30 mils).

PARAFFINUM DURUM.

Hard Paraffin.

Hard paraffin is a mixture of solid hydrocarbons.

CHARACTERS.—A somewhat translucent, colourless, cryst line, inodorous, tasteless solid, slightly greasy to the tou Melts at 50° to 60 C., burns with a bright flame. *Solubilit* Freely in ether and chloroform; slightly in alcohol; not all in water

PARAFFINUM MOLLE.

Soft Paraffin. *Synonym.*—Vaseline.

Soft paraffin is a mixture of semi-solid hydrocarbons

CHARACTERS.—A white or yellowish, translucent, soft a greasy semi-solid, free from any unpleasant odour or flavou Melts at 42° to 46°C. Insoluble in water.

Preparation.

Unguentum Paraffini. Hard Paraffin, 27 soft paraffin, 70; white beeswax, 3. When paraff ointment is the basis of white ointments, it should b made from white soft paraffin; when it is the basi of coloured ointments it should be made from yellow soft paraffin. In order to meet the exigencies climate and temperature the proportion of hard an soft paraffin may be varied.

USES.

As paraffins cannot become rancid, or irritate the skin, and as they are not acted upon by acids or alkalies, or by powerful oxidizing agents (e.g. chromic acid), they form a very good basis for many ointments; but as they are absorbed with difficulty, they are not a suitable vehicle for the absorption of drugs by the skin. Therefore paraffin ointment should only be used as a basis when it is desired that the ointment shall protect sores or wounds. A teaspoonful of vaseline is a good aperient. Like liquid paraffin, it may be taken for a long period, and does not gripe. Both it and liquid paraffin may be flavoured to taste.

BENZENUM.

Benzene. A mixture of homologous hydrocarbon obtained from light coal-tar oil. It contains about 70 per cent of benzene, C_6H_6, and 20 to 30 per cent. toluene, $C_6H_5CH_3$.

CHARACTERS. A colourless volatile liquid free from opalescence, with strong characteristic odour. Sp. gr. 0·88 to 0·887. Used to make Liquor Caoutchouc and Charta Sinapis. Called Benzol, B. P. 1898.

ACTION AND THERAPEUTICS.

One free application will destroy pediculi capitis and pediculi pubis.

Purified benzol (dose, 5 to 20 ♏, 3 to 12 decimils) in sugar, or suspended in mucilage, has been given for winter cough and for whooping-cough.

CARBON DISULPHIDUM.

Carbon Disulphide. CS_2.

SOURCE. May be prepared by combining carbon and sulphur at a high temperature.

CHARACTERS. Clear, colourless, highly refractive liquid with characteristic odour. Sp. gr. 1·268 to 1·269. Very slightly soluble in water, but soluble in alcohol, ether, chloroform, fixed and volatile oils.

Called Carbonis Bisulphidum, B. P. 1898.

MICROCOPY RESOLUTION TEST CHART

APPLIED IMAGE

USES.

Used to make Liquor Caoutchouc and Pilula Phosphori.

Carbon Dioxide.—(Not official.) *Synonym*: Carbonic snow.

The gas in cylinders at a pressure of 65 atmospheres is allowed to escape into some suitable receptacle, such as a towel rolled so as to form a tube. The gas condensing forms a semi-solid snow, which can be formed into a stick or crayon. It can be moulded or cut with a knife to form a pencil which, covered to protect the hand, may be applied to naevi, port-wine stains, lupus or rodent ulcer. The pencil should be of such a size that when pressed down on the diseased part it covers the whole of it, if small, or a part 1 inch in diameter if large. The application is usually for about half a minute or a little longer. On removal, some simple ointment is applied. This treatment is excellent for removing the above conditions.

PART II.—ORGANIC MATERIA MEDICA.

SECTION I. PHARMACOPŒIAL SUBSTANCES DERIVED FROM THE VEGETABLE KINGDOM.

THE drugs comprehended in this section may be arranged in many ways, but there are objections to each. Inasmuch as the medical student has to be well acquainted with the action of these drugs in health and disease, those which act similarly will be grouped together.

GROUP I.

Drugs acting chiefly on the Nervous System.

These may be classified as follows.

CLASS I. Acting on the cerebrum.

A. Cerebral depressant or soporific:

Opium.

B. Cerebral excitants:

Deliriants:
- **Belladonna.**
- **Stramonium.**
- **Hyoscyamus.**
- **Duboisine.**

Also act on nerve endings in glands and in voluntary muscle. Possibly **Grindelia** also.

Cannabis Indica.
Caffeine.
Guarana.

CLASS II. Acting on the spinal cord.

A. Exciting the anterior cornua. **Strychnine.**
B. Depressing the anterior cornua. **Calabar bean, Gelsemium.**

CLASS III. Acting on the nerves.

A. Depressing the motor nerves. **Conium, Tobacco.**
B. Depressing the sensory nerves. **Cocaine. Kava.**
C. Stimulating the secretory nerves. **Jaborandi. Muscarine.**
D. Depressing the secretory nerves. **Agaricin.**
E. Depressing the motor end plates. **Curare.**

Class I.—Vegetable Drugs acting chiefly on the Cerebrum.

OPIUM.

Opium. The juice obtained by incision from the unrip capsules of *Papaver somniferum*, the white poppy, inspissat by spontaneous evaporation. Any suitable variety of opiu may be used to obtain the liquid extract and the tincture of respective alkaloidal strengths, provided that when dry contains not less than 7·5 per cent. of anhydrous morph but otherwise the preparations of opium must be made fro opium of such a strength that when dried and powdered it shall yield from 9·5 to 10·5 *per cent. of morphine.* Op containing more morphine may be diluted to that strength b the addition of opium containing between 7·5 and 10·5 per ce of morphine or by milk sugar.

Characters. Rounded, irregular, or flattened masse commonly from 250 to 1000 grms. in weight. When fresh it is plastic, moist, coarsely granular, reddish or chestnut-bro but becoming harder by keeping, and darkening to black brown. Odour strong, peculiar, narcotic. Taste nauseou bitter.

This official variety is commonly called *Asia Minor opium* (*Synonyms.* Smyrna, Turkey, and Levant opium).

Varieties. In addition to Asia Minor opium the followin are met with in commerce. (*a*) Constantinople opium, sm lenticular masses, ¼ to ½ lb. in weight, and enclosed in a popp leaf. Sometimes the terms Turkey and Levant opium includ this. (*b*) Egyptian opium. Flat, more or less circular c two or three inches in diameter, reddish hue intern covered with a leaf externally. Persian, Indian, En French, and German opiums are rarely met with in Eng

Composition. (1) *Alkaloids.* At least eighteen in number. Most are combined with meconic acid, some with sulphuric acid, and some are free. Some morphine salts, codeine and its phosphate are official. Morphine, codeine, narcotine, and thebaine are important. The following are the alkaloids existing in opium:

Morphine (up to 12 per cent.).
Codeine (up to ·6 per cent.).
Thebaine (up to ·3 per cent.).
Narcotine (also called Anarcotine).
Narceine.
Papaverine.
Pseudo-morphine.
Protopine.
Oxynarcotine.
Cryptopine.

Hydrocotarnine.
Laudanine.
Laudanosine.
Meconidine.
Rhoeadine.
Codamine.
Gnoscopine.
Lanthopine.

(2) *Neutral bodies.* Two in number:
Meconin.
Meconoiosin.

(3) *Organic acids.* Two in number:
Meconic acid.
Thebolactic acid.

(4) *Water, 16 per cent.*

(5) *Mucilage, resin, albumen, glucose, fat, essential oil, [illegible] extractives, and salts of ammonium, calcium, and magnesium.*

The following analysis shows how specimens vary. Two specimens yielded:

	Morphine per cent.	Anarcotine per cent
Patna opium	3·98	6·36
Smyrna opium	8·27	1·94

IMPURITIES. Water, stones, fruits, leaves, starch, &c. gr. dried at 100°C. should yield **9·5 to 10·5 gr. of morphine**

INCOMPATIBLES. Perchloride of iron gives a deep red ur (due to meconic acid). Salts of zinc, copper, and arsenic, er nitrate, acetate and subacetate of lead, give precipitates conates, sulphates, and colouring matters. All tannin taining preparations precipitate codeine tannate. Fixed alies, their carbonates, and ammonia precipitate morphine narcotine. The small amount of glucose in opium may it to explode when made into a pill with nitrate of silver

Dose, ½ to 2 gr. 3 to 12 centigrms.

Preparations.

1. Extractum Opii Siccum. Sliced opium, distilled water. *Standardized to contain 20 per cent. of morphine.* (To obtain the correct strength, stronger and weaker extracts may be mixed, or stronger diluted with water or calcium phosphate.)

This is Extractum Opii, B. P. 1898.

Dose, ¼ to 1 gr. 16 to 60 milligrms.

2. Extractum Opii Liquidum. Dry extract of opium, 37·5; alcohol (90 per cent.), 200; water to produce 1000. *Standardized to contain 0·75 per cent* *of morphine.* (Official imitation of Liquor Opii Sedativus or Battley's Sedative Solution.)

Dose, 5 to 30 m. 3 to 18 decimils.

3. Pilula Plumbi cum Opio. Powdered opium 12; lead acetate, 80; syrup of glucose, 8. *Strength* *opium.*—1 in 8.

Dose, 2 to 4 gr. 12 to 25 centigrms.

4. Pilula Saponis Composita. Powder opium, 1; hard soap, 3; syrup of glucose, 1. *Strengt of opium.* 1 in 5. (Often wrongly called Pilula Opii

Dose, 2 to 4 gr. 12 to 25 centigrms.

5. Pulvis Cretæ Aromaticus cum Opio. Powdered opium, 2·5; aromatic chalk powder, 97 *Strength of opium.*—1 in 40.

Dose, 10 to 60 gr. 6 to 40 decigrms.

6. Pulvis Ipecacuanhæ Compositus. *Synonym.* Dover's powder. Powdered opium, 1; ipecacuanha, 1; potassium sulphate, 8. *Strength of opium* 1 in 10.

Dose, 5 to 15 gr. 3 to 10 decigrms.

7. Pilula Ipecacuanhæ cum Scillà. Compound ipecacuanha powder, 3; squill, 1; ammoniacum, 1; syrup of glucose, q.s. *Strength of opium.* 1 in 20

Dose, 4 to 8 gr. 25 to 50 centigrms.

8. Pilula Ipecacuanhæ cum Urginea. Compound ipecacuanha powder, 3; urginea, 1: ammoniacum, 1; syrup of glucose, q.s. *Strength of opium* 1 in 20

Dose, 4 to 8. -25 to 50 centigrms.

9. Pulvis Kino Compositus.—Powdered opium, 1; kino, 15; cinnamon, 4. *Strength of opium* 1 in 20.

Dose, 5 to 20 gr. 3 to 12 decigrms.

10. Pulvis Opii Compositus. Powdered opium, 10; black pepper, 15; ginger, 30; caraway, 42 tragacanth, 3. *Strength of opium.*—1 in 10.

Dose, 5 to 15 gr. 3 to 10 decigrms.

11. Suppositoria Plumbi Composita.—Powdered opium, 0·8 grm.; lead acetate, 2·4 grm.; oil of theobroma, q.s. to make twelve. *Strength of opium.* 1 gr. (0·067 grm.) in each.

12. Tinctura Opii. *Synonym.* Laudanum. Powdered opium, 200; alcohol (90 per cent.), and water, q.s. *Standardized to contain 1·0 per cent. of anhydrous morphine.* That is 1 grm. in 100 millilitres or 1 gr. in 110 ♏. It is one-third stronger than the corresponding preparation, B. P. 1898.

Dose, 5 to 15 m. 3 to 10 decimils for repeated, **20** to **30 m. 12 to 18 decimils** for single administration.

A preparation of opium called Nepenthe is one-third less strong than Tinctura Opii. Sydenham's laudanum is a tincture of opium flavoured with saffron. Acetum Opii Crocatum (black drop) is three times as strong as Tinctura Opii.

13. Linimentum Opii. Tincture of opium and soap liniment, equal parts. *Strength of morphine.*—0·5 per cent.

14. Tinctura Camphoræ Composita. *Synonym.*—Paregoric. Tincture of opium, 50; benzoic acid, 5; camphor, 3; oil of anise, 3; alcohol (60 per cent.) to make 1000. *Strength.*—Contains 5 milligrms. morphine in 10 millilitres (0·05 per cent.) or $\frac{1}{37}$ gr. in 1 fl. dr.

Dose, $\frac{1}{2}$ to 1 fl. dr. 2 to 4 mils.

15. Tinctura Opii Ammoniata. *Synonym.* Scotch paregoric. Dissolve benzoic acid, 20; and oil of anise, 5, in alcohol (90 per cent.), 600. Add tincture of opium, 100, solution of ammonia, 200, and alcohol (90 per cent.) to make 1000. *Strength.* This contains 0·1 grm. of morphine in 100 millilitres or $\frac{1}{10}$ gr. in 110 ♏. It contains $\frac{1}{10}$ less morphine than in B. P. 1898

Dose, $\frac{1}{2}$ to 1 fl. dr. 2 to 4 mils.

16. Unguentum Gallæ cum Opio. Powdered opium, 75; ointment of galls, 925. *Strength of opium.* 1 in $13\frac{1}{3}$.

17. Unguentum Myrobolani cum Opio.—Powdered opium, 75; myrobalan ointment, 925. *Strength of opium.*—1 in $13\frac{1}{2}$.

It will be noticed that

From *Extractum Opii Siccum* there is prepared Extractum Opii Liquidum.

From *Pulvis Ipecacuanhæ Compositus* there is prepared Pilula Ipecacuanhæ cum Scillâ and Pilula Ipecacuanhæ cum Urginea.

From *Tinctura Opii* there are prepared Linimentum Opii, Tinctura Camphoræ Composita, and Tinctura Opii Ammoniata.

The following list, in which the doses are arranged approximately according to those given in the Pharmacopœia may assist the student. The strength of opium in preparations standardized to contain a definite amount of morphine is of course only approximate.

Strength of Opium.	*Name.*	*Approximate Dose*
1 in ½	Ext. Opii Siccum	¼–1 gr. 16 to 60 milligrm
1 in 5	Pil. Saponis Co.	2–4 gr. 12 to 25 centigrms
1 in 8	Pil. Plumbi c̄ Opio	
1 in 10	Pulv. Opii Co.	2–10 gr. 12 to 60 centigrms
1 in 20	Pil. Ipecac. c̄ Scillâ	
1 in 20	Pil. Ipecac. c̄ Urgineâ	
1 in 9	Tinct. Opii	5–20 gr. or ♏ 3 to 12 decigrms or decimils.
1 in 10	Pulv. Ipecac. Co.	
1 in 12	Ext. Opii Liq.	
1 in 20	Pulv. Kino Co.	
1 in 40	Pulv. Cret. Aromat. c̄ O.	10–40 gr. 6 to 40 decigrm
1 in 90	Tinct. Opii Ammon.	30–60 ♏ 2 to 4 mils
1 in 220	Tinct. Camph. Co.	
1 gr. in each	Suppositoria Plumbi Co	
1 in 13¼	Ung. Gallæ c̄ Opio	
1 in 13½	Ung. Myrobalani c̄ Opio	
1 in 18	Linimentum Opii	

Morphinæ Hydrochloridum. Morphine Hydrochloride. $C_{17}H_{19}NO_3,HCl,3H_2O$.

Source. The hydrochloride of an alkaloid obtained from opium.

Characters.—White acicular, silky prisms or a white powder of minute cubical crystals. *Solubility.* 1 in 25 of water; 1 in 50 of alcohol (90 per cent.); 1 in 8 of glycerin.

Incompatibles.—Salts of lead, iron, copper, mercury, and zinc; alkaline earths; lime water; Liquor Arsenicalis; all substances containing tannin.

Dose, ⅛ to ½ gr. 8 to 30 milligrms.

Preparations.

1. Liquor Morphinæ Hydrochloridi. Morphine Hydrochloride, 1; dilute hydrochloric acid, 2; alcohol (90 per cent.), 25; water, to make 100. *Strength.* 1 per cent. or 1 gr. in 110 ♏, 1 grm. in 100 millilitres, or about 4½ gr. of the hydrochloride to 1 fl. oz.

Dose, 10 to 60 m. 6 to 36 decimils.

2. Suppositoria Morphinæ. Morphine Hydrochloride, 0·2 grm.; oil of theobroma, q.s. to make twelve. *Strength.* 1 in 60. Each contains 0·017 grm. (¼ gr.) of morphine hydrochloride.

3. Tinctura Chloroformi et Morphinæ Composita.—*See* p. 297. *Strength.*—$\frac{1}{11}$ gr. in 10 ♏.

Dose, 5 to 15 m.—3 to 10 decimils.

4. Trochiscus Morphinæ. Morphine Hydrochloride, 0·002 grm.; with tolu basis. *Strength.* 0·002 grm. or $\frac{1}{32}$ gr. in each.

5. Trochiscus Morphinæ et Ipecacuanhæ.—Morphine Hydrochloride, 0·002 grm.; ipecacuanha, 0·006 grm.; with a tolu basis. *Strength.* 0·002 grm. of morphine hydrochloride or $\frac{1}{32}$ gr. in each.

Morphinæ Acetas. Morphine Acetate. $C_{17}H_{19}$ $O_3,C_2H_4O_2,3H_2O$. The use of the acetate is diminishing, as unstable, losing acetic acid on exposure to air.

SOURCE. Morphine is dissolved in acetic acid and water and the neutral solution is evaporated.

CHARACTERS.—A white crystalline or amorphous powder. *Solubility.* 1 in 2½ of water. Many specimens are not so soluble. 1 in 100 of alcohol (90 per cent.); 1 in 5 of glycerin.

INCOMPATIBLES.—As morphine hydrochloride.

Dose, ⅛ to ½ gr. 8 to 30 milligrms.

Preparation.

Liquor Morphinæ Acetatis. Morphine Acetate, 1; dilute acetic acid, 2; alcohol (90 per cent.), 25; distilled water, to make 100. *Strength.* 1 per cent. or 1 gr. in 110 ♏, 1 grm. in 100 millilitres, or about 4½ gr. of the acetate to 1 fl. oz.

Dose, 10 to 60 m.—6 to 36 decimils.

Morphinæ Tartras. Morphine Tartrate (C H $NO_3)_2,C_4H_6O_6,3H_2O$.

SOURCE. May be obtained by the combination of phine and tartaric acid.

CHARACTERS. A white powder consisting of tuft minute acicular crystals. *Solubility.* 1 in 11 of cold wate not in alcohol.

INCOMPATIBLES.—As morphine hydrochloride

Dose, $\frac{1}{8}$ to $\frac{1}{2}$ gr. 8 to 30 milligrms.

Preparations.

1. Injectio Morphinæ Hypodermica. Morphine tartrate, 2·5; water, 100. *Strength.* 2 per cent.; 2·5 grms. in 100 millilitres; 2·5 gr. 110 ♏. NOTE. It is one-half the strength of corresponding preparation, B. P. 1898.

Dose, 2 to 5 m. 3 to 6 decimils cutaneously.

2. Liquor Morphinæ Tartratis. Morphine tartrate, 1; alcohol (90 per cent.), 25; water, 10 *Strength.* 1 per cent., or 1 gr. in 110 m. 1 grm. in 10 millilitres, or about 4⅜ gr. of the tartrate to 1 fl. oz

Dose, 10 to 60 m. 6 to 36 decimils.

ACTION.

The action and uses of opium in man are due almost entirely to its morphine, and therefore they may be studied together. For Codeine, *see* p. 378.

External. Opium probably has no action when applied to the unbroken skin, but it has been said to be slightly anodyne. It can be absorbed from and relieve the pain of raw surfaces.

Internal. *Alimentary canal.*—As far as we know opium **diminishes** all the **secretions** of the body except the sweat. The mouth consequently becomes dry, and the patient feels thirsty, but after a small dose not markedly so. This effect is partly due to the direct action of the opium on the mouth, but to a less extent to its influence exerted after it has been absorbed. In the stomach and intestine, by the same double action, the secretion of the gastric and intestinal juices is diminished. The drug also paralyses the peristaltic movements of the stomach and intestines. This is due to its action on the nervous or muscular structures in the wall of the intestine itself. The result of the diminution of secretion and peristalsis is that opium appeases hunger, often causes **indigestion**, almost always gives rise to **constipation**, and if vomiting or diarrhœa is present it may prevent

These actions are also in part due to its general sedative influence on the nervous system. If pain exists in the abdomen or elsewhere opium is a powerful **anodyne**. Most of it is absorbed, but rather slowly. If injected subcutaneously it is excreted into the stomach and bowels. With some persons it causes **vomiting**, often most marked many hours after the drug has been taken. Whether the biliary and pancreatic secretions are diminished is not known. Much of the morphine taken is excreted in the fæces.

Blood.—Morphine for the most part circulates in the blood as such, and is excreted almost entirely by the intestinal mucous membrane, and very slightly by the kidneys, but a small part of it is destroyed in the body, probably in the liver; if morphine is taken habitually, the amount so destroyed gradually increases, and this explains why some persons can take such large quantities The fate of the other alkaloids is not known, nor are we aware of any direct action of any of the constituents of opium on the blood itself.

Circulation. In an ordinary healthy man small doses of opium hardly affect the heart or vessels, but with those who are ill morphine often makes the **pulse slow**. Patients rarely die from the direct effect of opium on the heart and its nervous apparatus, this being much less important than the influence on respiration, and some of the cardiac depression may be secondary to asphyxia.

The vaso-motor centres are slightly depressed by moderate doses, hence the **vessels**, particularly those

of the skin, dilate; with large doses the depression considerable.

Respiratory. Opium is a **direct poison** to the **respiratory centre.** Breathing therefore becomes slow, less air is taken in at each inspiration, and death takes place from **asphyxia.** The secretion of bronchial mucus is decreased.

Nervous system. Brain. The **higher faculties** are at first **excited** by small doses. In a few persons there is no incoordination in this excitement. The intellectual power and mental vigour are increased, and therefore the drug is taken by some people to enable them to do their mental work. Usually, however, the excitation does not affect the mind evenly; generally the imagination is powerfully and pleasantly excited, much more so than the faculties of reason and judgment, which are a little dulled. The expression on the face is one of happiness and comfort, and this corresponds with the condition of mind, which is in a state of peace, calm, and happiness. This is soon succeeded by **sleep**, which is accompanied by pleasant dreams, generally of an impossible nature. With some persons, however, the sleep is quite dreamless. This, which is the beginning of the depression of the highest centres, is soon followed by depression of the others, the higher being influenced before the lower, so that soon the sleeper does not respond to any sound, light, or cutaneous stimulation, **nor does he feel pain.** It is this last fact that makes the drug so invaluable, especially as the quantity of morphine necessary to relieve pain is often insufficient to cause much general depression. If a large or even moderate amount is given, generally there is no primary excitement, and then the first symptom that opium has been taken is drowsiness. On waking from sleep induced by opium some persons feel quite well, but usually there is a little languor, headache, and nausea. Opium eaters take it for its stimulant effect. It is given medicinally as a hypnotic and anodyne. The **pupil** is **contracted**; this is due to the effect of the drug on the pupillary centre in the floor of the aqueduct of Sylvius. In man, just as the stimulation of the intellectual centres is brief, so is that of the cerebral motor centres—in fact, it is often difficult to detect any evidence of it. Their subsequent depression is never so marked as that of the intellectual faculties; for although there is languor and muscular weakness, and the patient always lies down, yet he can be walked about if he is supported. Vomiting is occasionally caused by transient irritation of the vomiting centre, but soon this is depressed, and therefore emetics do not act well in cases of opium poisoning.

The motor cells of the **spinal cord** are at first slightly stimulated, and consequently reflex excitability is exaggerated; but they are soon **depressed**, and it is difficult to obtain reflex movements.

The excitability of motor and sensory nerves is unaltered except that in the later stages of opium poisoning by enormous doses it is depressed, that of the sensory before the motor. The muscles remain irritable to the last.

Opium, in its action on the nervous system, illustrates the common fact that functions at first stimulated by a drug are usually subsequently paralysed by it (*see* p. 109); and it affords an excellent example of the law of dissolution, for higher functions, such as the intellectual and imaginative, are first affected; motion is then disordered; next the pupillary centre, and then the medullary centres for respiration and cardiac action are implicated. The spinal cord is influenced to a less degree, the nerves very slightly, and the muscles not at all.

In **man** the peculiarities of the action of morphine are the slightness of the stage of stimulation, its predominating influence on the higher mental functions, and the slight affection of the motor and the vaso-motor centres, the cord, the nerves, and the muscles. In **frogs** morphine produces violent convulsions, because its predominating action is to stimulate the spinal cord. **Birds** are only affected by large doses, which produce coma. **Mammals** are for the most part affected in the same way as man, except that the first or excitement stage is more marked; hence with many mammals, especially cats morphine is a violent convulsant; dogs and rabbits require large doses to produce symptoms.

Kidneys.—Sometimes opium slightly increases, sometimes it slightly decreases, the urinary flow. As already stated, morphine is decomposed in the body for oxydimorphine has been found in the urine of those taking morphine.

Skin.—Opium is a mild **diaphoretic.** It may cause itching.

Metabolism.—If the person taking it has glycosuria, the amount of sugar he passes in the urine is frequently diminished. General metabolism is slightly decreased also, for the amounts of nitrogen and carbonic acid excreted and oxygen absorbed are lessened.

Temperature.—Large doses depress this, probably from the effect of the drug on the thermogenetic nerve centres.

Persistent use of large doses decreases the secretion of milk and the menstrual discharge. Morphine is excreted by the milk, and so may affect the child.

Peculiarities.—There are few drugs which have such different effects upon different people. The above description states the manner in which most human beings are affected by opium, but in some the stage of excitation is very evident, so that they become delirious and cannot sleep. In others, vomiting and indigestion are very marked. Some of these pecu arities are due, no doubt, to the varying composition of opium. **Children** are easily poisoned by it, and therefore only **small doses** should be administered to them; women are more readily affected than men. Persons who take it habitually soon tolerate enormous quantities. It may produce an erythematous eruption on the skin.

Differences in action between opium and morphine. (**1**) Morphine, being more readily absorbed, acts more quickly. It is especially suited for subcutaneous injection; given in this way it acts very rapidly. (**2**) Opium is more liable to upset the digestion and to cause constipation, but this last fact often makes it the more valuable in many abdominal diseases. (**3**) Opium is the better diaphoretic. (**4**) Morphine is more certain in its action as an anodyne and soporific; possibly this is because of the other powerful alkaloids in opium. (**5**) Opium is stated to act more powerfully in reducing the amount of sugar present in the urine in glycosuria.

THERAPEUTICS.

External. Hot fomentations or poultices sprinkled with laudanum are often applied to painful parts, but probably it is the heat and not the opium which relieves the pain. Linimentum Opii rubbed into the skin diminishes the pain of chronic rheumatism and myalgia; probably in this case the friction is more efficacious than the opium. Locally applied to sores and ulcers, it may soothe the pain due to them. The ointment of galls and opium will often relieve the pain of piles and anal fissures, especially if a mild laxative is given by the mouth.

Internal. *Stomach.* Morphine is of great service for the pain of gastric ulcer, cancer, or even for simple painful dyspepsia. One of the official solutions of morphine (15 ♏, 1 mil, doses) is preferable to opium, as that may aggravate the indigestion. They are frequently combined with preparations of bismuth, and taken immediately before or after meals. Many forms of vomiting are relieved by morphine because it decreases pain, peristalsis, and excessive secretion.

Intestines.—Opium is invaluable for stopping many varieties of diarrhœa. If they will yield to any treatment, opium is most likely to be successful. Intestinal colic, being due to irregular excessive peristaltic action, is generally relieved by opium and indeed, so is abdominal pain of all sorts. If in acute inflammatory conditions of the peritoneum, as appendicitis or general peritonitis, no operation is anticipated, full doses of opium must be given, the object being so to paralyse the intestinal movements as to prevent the peritoneal surfaces rubbing against each other. It is much used after operations or wounds in the abdomen. Opium is preferable to morphine for abdominal cases; if they are severe it must be boldly pushed, the patient being kept just drowsy with slightly contracted pupils, and it often does not matter if the bowels are not open for a week or even more. It should rarely be given if an abdominal operation is impending, for it masks the symptoms.

Heart.—Much skill is required to give opium properly in heart disease. The hypodermic injection of morphine is, on the whole, to be preferred to opium. The great indication for it is when cardiac pain and distress keep the patient awake. Often it acts like a charm, a quiet refreshing sleep being the result of a single injection. No doubt it is a cardiac depressant, but we have to set against this the exhaustion of pain and insomnia. Still, if the patient is very ill, these two factors must be carefully balanced. It likewise often relieves the pain of aneurysm and intra-thoracic growths. Its depressant effect may be to some extent counterbalanced by combining atropine with morphine.

Vessels. Opium is a good hæmostatic as it quiets voluntary movements. It is probably efficient r absorption, but its great value is in gastric and stinal hæmorrhage, when it acts partly by pping peristaltic movements. An excellent form which to give it is the Pilula Plumbi cum Opio. I s also very useful in hæmoptysis, for it acts as a mostatic and relieves the cough.

Respiration. It will be remembered that opium presses the respiratory centre; therefore it, by minishing the activity of the centre for the reflex of coughing, will often alleviate this distressing ptom, but it is only justifiable to give it when irritation which reflexly sets up a cough is movable, as in intra-thoracic growth or aneurysm, when there is little or no lividity and yet the cough violent, as is often the case in pleurisy, and to a extent in phthisis. The liability to lividity and hyxia in many diseases attended with cough must er be forgotten. Thus opium is quite inadmissible he last stages of bronchitis and pneumonia, and, a rule, in even the earlier stages of bronchitis er means of relieving the cough should be tried : and if opium is given, it must be administered h caution and judgment. But in pneumonia with lividity it is very useful, lessening cough and pain promoting sleep. A "linctus opiatus," a favourite edy, is often given at night when a cough ps the patient awake. It may consist of tinc of opium, 2 ♏ (12 centimils); dilute sulphuric , 2 ♏ (12 centimils); treacle, 30 ♏ (2 mils): r to 1 fl. dr. (4 mils). The object of the treacle soothe the pharynx locally. Opium must also given cautiously for asthma, as there is in this ase a great liability to the growth of a per nent opium habit. An insufflation of ½ gr (30 grms.) of acetate of morphine with 5 gr. (8 grms.) of starch is of great use when blown on to a larynx painful from organic disease. A grain o boric acid or a grain of iodoform is often added t each insufflation.

Nervous system.—*Brain.*—It is in its action o this organ that the marvellous value of opium is seen its great function being to relieve pain and to produce sleep when that is prevented by pain. Fo these purposes it is best given hypodermically a morphine, for that acts more quickly, more certainl and is less liable to produce indigestion and excitement than opium. Many like to inject a solution containing $\frac{1}{50}$ gr. (1·25 milligrm.) of atropine sulphate to each $\frac{1}{2}$ gr. (30 milligrms.) of morphine salt, for by so doing the liability of morphine t upset the stomach and bowels is diminished, and its efficacy as an anodyne is not sensibly lessened. It would be a long list to give all the diseases the pain of which can be relieved by morphine: cancer and fractures are typical instances. Morphine is very valuable for the insomnia of acute diseases; but it should never be prescribed for habitual sleeplessness, for fear the patient should contract the habit of opium taking—unless the disease causing the insomnia is incurable and will not las long, when the use of opium is quite justified. It should be given cautiously in gout, for that is often accompanied by granular kidneys; and not for hysteria, as often it does not relieve hysterical pains, and an opium habit may be formed. It is especially useful in renal and biliary colic, and for the after-pains of a confinement. In these cases it relieves the pain partly from its power as an anodyne, and also because by its paralysing effect on unstriped muscle it relaxes the muscular contraction. This property also makes it valuable in some cases of spasmodic stricture of the urethra. It may be given as a sedative in delirium tremens and some forms of mania, but often such large doses are required that its use is not justifiable.

Patients suffering great pain can take enormous doses without any symptoms of poisoning.

Spinal cord.—Its use for the pains of locomotor ataxy and for convulsive diseases is to be deprecated. The morphia habit is easily formed.

Kidneys.—It should always be remembered that phine is excreted with great difficulty if the dneys are diseased. There are several cases re led in which persons suffering from Bright's ase have been killed by quite small doses of um. But it often so markedly relieves uræmic pnœa, uræmic insomnia, the cardiac dyspnœa ch may complicate Bright's disease, and even mic convulsions, that it may be justifiable to ect $\frac{1}{5}$ of a grain (12 milligrms.) of a salt of phine subcutaneously into a patient suffering n one of these conditions and run the slight there is of poisoning him. But it is clear that treatment must be adopted very cautiously.

Skin.—Combined with ipecacuanha as Dover's der, opium is commonly given as a mild diapho- in cases of slight inflammatory disorder, such as mmon cold.

Metabolism.—Opium is administered to persons ering from diabetes and the amount of sugar in urine often certainly diminishes and the patient's neral health improves. Opium can, in the opinion many, control all varieties of inflammation ; there- it is given for a cold in the head, for cystitis, urisy, &c. Occasionally persons taking opium r from retention of urine. We have indicated occasions on which opium and morphine are pectively preferable.

Toxicology.

Acute poisoning.—There may be slight preliminary excita ity, but soon drowsiness sets in ; this is followed by incapacity exertion, sleep, and finally deep coma. The pupils are minutely contracted. At first the patient can be roused. b soon no stimulation will do this. Reflex action is abolished. The skin is cold, the face and lips are livid, and toward end bathed in sweat. The pulse is weak and slow The r ration becomes slower and more irregular, at last it is stert and the patient dies from asphyxia.

Diagnosis of poisoning by opium. **(1)** *From alco poisoning.* Often very difficult, especially if, as comm happens, the man poisoned with opium has taken alcoh had it given him. The pupils are more contracted in op poisoning. The patient is more easily roused in al poisoning. Examine the urine for morphine and al Get a careful history. **(2)** *From cerebral hæmorrhage.* this is in the pons Varolii the pupils may be very contrac and the diagnosis difficult, but look carefully for local paralyses. Usually cerebral hæmorrhage takes place into internal capsule, and then the face and the limbs on the op ite side are paralysed. If the hæmorrhage is a small one, a especially if it is in the pons, the temperature may be ra if it is a very large one the temperature falls for the few hours, but may rise subsequently. If the pupils ar unequal the case is one of cerebral hæmorrhage. **(3)** *Fr carbolic acid poisoning,* in which there may be coma contracted pupils. The acid produces white patches i mouth, and the odour is characteristic. **(4)** *From chlorofor and ether poisoning* by the odour of the breath and vomited matters. **(5)** *From uræmia* by the signs of Br disease, especially albuminuria. **(6)** *From diabetic coma* by the smell of the breath and the glycosuria. **(7)** *From coma stage of an epileptic fit* by the history, the dilatation of the pupils, and the fact that the lividity does not deepen. **(8)** *From the same stage of a fit in general lysis* of the insane and other nervous diseases by the same symptoms.

Post mortem. The appearances after death from opium poisoning are those always found after fatal asphyxia.

Treatment. Wash out the stomach at half-hour interva with Liquor Potassii Permanganatis (which decomposes phine) diluted with three times the quantity of warm wa leaving about 5 fl. oz. in the stomach. Give prompt emetics (p. 145), as apomorphine subcutaneously. Always rouse patient by walking him about, flapping him with a tow pinching him, applying the faradic current, and putting ammonia to the nose; a pint of strong coffee should be injected into the rectum, $\frac{1}{20}$ gr. atropine sulphate given subc sly, or 30 ♏ of tincture of belladonna by the mouth d every quarter of an hour. If the breathing is very nt, artificial respiration should be employed. Oxygen or nitrite inhalations may be used. The treatment must be p for several hours if necessary.

Chronic Morphine poisoning. As many persons ad ter the drug subcutaneously to themselves, chronic ing is very common. The symptoms are that the loses all sense of right and wrong, he will lie and in the most degrading way, especially if his desire obtain the drug, and absolutely no statement that he can be trusted. He neglects his work, and lets his ess go to ruin. He wastes and becomes anæmic, he from loss of appetite, indigestion, dry mouth, sluggish and a foul tongue. The nails are brittle, the skin he hair turns grey early, and falls out. There is sexual nce, no erections take place, no semen is secreted; is amenorrhœa, and the flow of milk is stopped, but polyuria. The pupils are small, and loss of muscular ight ataxy and tremor are present in severe cases. arm or other parts are scarred with marks of the syringe. 20 grains of morphine a day are sometimes taken.

The patient must be isolated and carefully watched to see he gets no morphine (he often eludes or bribes his nurse); ld be diminished gradually, so that at the end of a fort he is taking none. If it is stopped suddenly there may rious collapse and wild delirium. Relapses are very mon, and a complete cure after a relapse is very rare.

Antagonism.

tropine. Atropine (alkaloid of belladonna) is an anti to morphine, because it powerfully stimulates the re ry centre. It also stimulates the cerebral convolutions testinal peristalsis, both depressed by morphine. It s to be antagonistic to opium in other particulars, not really so. Thus, although it prevents perspiration ates the pupil, these effects are due to action on the eral nerve terminations, while morphine produces con results by acting on the central nervous system. Still been found that some of the undesirable effects that follow the subcutaneous injection of morphine, such as constipation, and cardiac depression, may be avoided to $\frac{1}{100}$ gr. of atropine sulphate is injected at the same

Omnopon. *Synonym.* Panopton (Not official)

A solution of the total alkaloids of opium as hyd-chlorides and freed from meconic acids, gums, and resin

Composition.—Morphine, 52 per cent ; narcotine, 20 per cent. ; codeine, 2 per cent. ; papaverine, 2·5 per cent. ; the-baine, 1 per cent. ; narceine, 1 2 per cent. ; other alkaloid 4 per cent. ; water, 8 per cent. ; hydrochloric acid, 9 per cent

It is grey powder. Readily soluble in water

Dose, [illegible] to [illegible] gr. 10 to 30 milligrms. by [illegible] **[illegible] to [illegible] gr. 10 to 20 milligrms.** subcutaneously.

1 gr. omnopon corresponds to 5 gr. opium

Omnopon is less toxic than morphine, and especially depresses the respiratory centre less ; so it is of considerable use to stop purposeless coughing. It is less effective in diminishing peristalsis, and therefore upsets digestion le It has no disadvantages to counterbalance these advantages

Codeina. Codeine. $C_{18}H_{21}NO_3,H_2O$

Source.—An alkaloid obtained from opium or morphine

Characters. Nearly colourless trimetric crystals. *Solubility.*—1 in 80 of cold water, 1 in 24 of boiling water, 1 in 2 of alcohol (90 per cent.), 1 in 2 of chloroform.

Dose, $\frac{1}{4}$ to 1 gr. 16 to 60 milligrms.

Codeinæ Phosphas. — Codeine Phosphate $C_{18}H_{21}NO_3,H_3PO_4,2H_2O$.

Characters.—White crystals, slightly bitter. *Solubility* 1 in 3·5 of water.

Dose, $\frac{1}{4}$ to 1 gr. 16 to 60 milligrms.

Preparation.

Syrupus Codeinæ Phosphatis.—Codeine phosphate, 1; distilled water, 3; syrup, to produce 200 *Strength.*—10 millilitres contain 0·05 grm. of codeine phosphate; 1 fl. dr. contains 0·27 gr.

Dose, $\frac{1}{2}$ to 2 fl. dr. 2 to 8 mils.

Action and Therapeutics.

It may produce tremors because it excites the cord more, and depresses the higher faculties and respiratory centre less, than morphine, and in man its physiological action is in all respects much less an that of morphine. It often relieves the hacking h of phthisis, and for this the official syrup of phosphate is very useful. It is also used for s of ovarian pain, and to diminish the glycosuria diabetes; but it is doubtful whether it does s more effectually than opium. For diabetes it usually given as a pill. The phosphate has the vantage of being much more soluble than codeine.

Thebaine (Not official) produces powerful convulsions by tion on the cord. Its subsequent depressant action is ght.

Anarcotine (Not official). This is also known as Narcotine, h is a bad name, for the drug does not cause sleep. It is in ague, and it is the chief constituent of Indian opium.

Apomorphinæ Hydrochloridum. Apomor ine Hydrochloride. $(C_{17}H_{17}NO_2,HCl)_2,H_2O$.

SOURCE. It is the hydrochloride of an alkaloid obtained m morphine. The morphine loses one molecule of water.

CHARACTERS. Small greyish-white, shining needles, turn green on exposure to light and air; faintly acid. *Solu ity.* 1 in 60 of water, 1 in 50 of alcohol (90 per cent.).

Dose, $\frac{1}{20}$ to $\frac{1}{10}$ gr. 3 to 6 milligrms. hypodermically. **to $\frac{1}{4}$ gr. 6 to 16 milligrms.** by the mouth.

Preparation.

Injectio Apomorphinæ Hypodermica. Apomorphine Hydrochloride 1, diluted hydrochloric acid, 1; distilled water, 100. *Strength.* 1 per cent., 1 grm. in 100 millilitres or 1 gr. in 110 m. Must be freshly prepared, as it does not keep.

Dose, 5 to 10 m. 3 to 6 decimils. hypodermically.

ACTION.

External.—None.

Internal.—*Gastro-intestinal tract.* Apomorphine the most powerful **emetic** we possess. It does not t locally on the stomach, but solely on the vomiting entre in the medulla. It is, therefore, an indirect emetic. This is shown by the fact that when th drug is injected subcutaneously it produces violen vomiting if the vessels are so tied that none ca reach the stomach, but not if they are so tied tha it cannot reach the medulla.

Circulation.—Therapeutic doses have no eff beyond the depressing action which may be attribute to the vomiting. Large doses cause a rise in th rate of the pulse, probably from stimulation of th accelerator nerves, and with fatal doses the pul rate falls, because the drug directly paralyses th cardiac muscle.

Respiration.—This is at first stimulated by the act of vomiting. The effect of poisonous doses i doubtful; probably they depress respiration. If the bronchial secretion is thick and viscid it is render more fluid by apomorphine.

Nervous system. The first result of toxic doses i to cause delirium. Finally there is paralysis of th motor nerves, and consequently of the muscles.

THERAPEUTICS.

Vomiting action. The advantages of apomorphine over other emetics are that it is certain, prompt, an powerful; it can be given when emetics introduc directly into the stomach would not act, and it does not irritate the stomach. It is largely used in cas of poisoning. It is usually given hypodermically. As the pharmacopœial injection will not keep, it i advisable to use gelatin discs of apomorphine hyd chloride, which can be dissolved as required.

Expectorant action.—It is, when given by the mouth, a valuable expectorant for chronic bronchit when we wish to diminish the viscidity of the ex pectoration. It may advantageously be combined with terebene suspended in mucilage, but the mix ture is very nasty. The Syrupus Apomorphin

B. P. C.), strength [illegible] gr. to 1 fluid drachm (2 milli[illegible]s. to 4 mils), dose ½ to 1 fluid drachm (2 to 4 mils), a good preparation. The drug may also be given as a lozenge.

Diamorphinæ Hydrochloridum. Diamorphine hydrochloride. $C_{21}H_{23}NO_5, HCl, H_2O$.

Synonyms. Heroin hydrochloride, diacetyl-morphine hydrochloride, aceto-morphine hydrochloride.

SOURCE. An alkaloid obtained by the action of acetic anhydride on morphine.

CHARACTERS. A white, bitter, crystalline powder.

Dose, [illegible] to [illegible] gr.—2·5 to 8 milligrms.

ACTION AND THERAPEUTICS.

This drug is used to allay cough, especially incessant cough, without much expectoration, and for this purpose it is one of the best drugs we possess. A good formula is diamorphine hydrochloride [illegible] gr. (3 milligrms.), with a drachm of each of syrup of codeine and syrup of Virginia prune, and another which is very pleasant contains terpin hydrate [illegible] gr. (30 milligrms.), diamorphine hydrochloride [illegible] gr. (1·6 milligrm.) to one drachm (4 mils) of the syrup of Virginia prune. It is known as Elixir of Heroin. The Elixir Acetomorphinæ et Pini Co. (B. P. C.), dose ½ to 1 fl. dr. (2 to 4 mils), is another good preparation. Diamorphine hydrochloride is perhaps most used in phthisis and asthma. It does not often produce the headache and other disagreeable effects which may follow morphine. A twelfth of a grain dissolved in water can be given every two hours by the mouth, or less subcutaneously. It prolongs inspiration, increases the depth of respiration, and depresses the respiratory centre: large doses may produce dangerous depression, and in some animals induces convulsions. Dionin or ethyl morphine, usually met with as a hydrochloride, has the same action as diamorphine, but is less powerf and occupies an intermediate position betwee diamorphine and codein. All three depress th respiratory centre less than morphine.

Cotarnine Hydrochloride. $C\,H\,NO_4C$ N fficial.) *Synonym.*—Stypticin

Prepared by oxidizing narcotine. It occurs as primro coloured crystals, very soluble in water and alcohol. It allied to hydrastinine, being methoxyl-hydrastinine.

Dose, ½ to 1 gr.—3 to 6 centigrms. internall hypodermically.

It is used to check hæmorrhage, especially uterine Stypticin wool, gauze, bougies, and ointment are employe locally.

RED POPPY PETALS.

Rhœados Petala. Red Poppy Petals. The fre petals of *Papaver rhœas.*

Characters.—Scarlet, smooth and lustrous, with a sme of opium and a bitter taste.

Composition. Red colouring matter, 40 per cent. Th consists of papaveric and rhœadic acids. It is soluble in wat The petals contain no morphine, nor have they any narc properties.

Preparation.

Syrupus Rhœados. Petals, 26; sugar, 7 alcohol (90 per cent.), 5; water to make 100. In h countries the proportion of alcohol may be a litt increased to prevent fermentation.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

Action and Uses.

Poppy petals are only used as a colouring agent.

BELLADONNA.

Belladonnæ Folia. Belladonna Leaves. T leaves, collected when the plant is in flower, and then dri of *Atropa belladonna. Synonym.* Deadly nightshade.

Characters.—Eight to twenty centimetres long, broadl ovate, acute, entire, glabrous or nearly so. The expressed juic or an infusion, dropped into the eye, dilates the pupi

Strength. Belladonna leaves must yield not less than 0·30 per cent. of alkaloids. *Resembling belladonna leaves.* Stramonium leaves, more wrinkled; hyoscyamus leaves, hairy.

COMPOSITION. The chief constituents are (1) *Atropine* (see p. 384). (2) *Hyoscyamine*, which is the same as daturine (see p. 396). These two alkaloids are optical isomers; atropine is optically inactive; hyoscyamine is lævorotatory, but otherwise chemically identical with atropine. Hyoscyamine is usually the more abundant, but the proportion of the two alkaloids varies according to the specimen and the method of extraction employed.

Belladonnæ Radix. Belladonna Root. The root of *Atropa belladonna*, collected in the autumn and dried.

CHARACTERS. Cylindrical branched pieces entire or longitudinally split, 15 to 30 centimetres long, 10 to 20 millimetres thick. Externally pale greyish brown, wrinkled longitudinally; fracture short. Internally the root is white and starchy, with a very evident radiate appearance. *Resembling belladonna root.* Pyrethrum root, which is unbranched, and has a burning taste and a radiate fractured surface. Scammony root is darker.

COMPOSITION. As of the leaves. Usually contains 0·4 to 0·5 per cent. of alkaloids, chiefly hyoscyamine.

Preparations.

1. Extractum Belladonnæ Liquidum. Prepared by repeated percolation of the root with alcohol (90 per cent.) and water. *Standardized to contain 0·75 per cent. of the alkaloids of the root.*

2. Extractum Belladonnæ Siccum. Prepared from the leaves by percolation with alcohol (70 per cent.). *Standardized to contain 1 per cent. of the alkaloids.*

This is Extractum Belladonnæ Alcoholicum, B. P. 1898.

Dose, ¼ to 1 gr. 16 to 60 milligrms.

3. Emplastrum Belladonnæ. Liquid extract, 50; evaporate and add resin plaster, 137·5. *Strength.* 0·25 per cent. of the alkaloids, and is one half the strength of Emplastrum Belladonnæ, B. P. 1898.

4. Linimentum Belladonnæ. Liquid extract, 50; camphor, 5; water, 10; alcohol (90 per cent.), 100. *Strength.* 0·375 per cent. of alkaloids.

5. Tinctura Belladonnæ. Belladonna leav dried and powdered, 1; alcohol (70 per cent.), 10 *Standardized to contain 0·035 per cent. of tota alkaloids.* This tincture contains $\frac{7}{10}$ of the alkaloi contained in the Tincture of Belladonna, B. P. 1898

Dose, 5 to 15 m. 3 to 10 decimils.

6. Unguentum Belladonnæ. Liquid extract, 8 benzoated lard, 6; wool fat, 2. *Strength.*—0·6 per cent of alkaloids.

In India benzoated suet should be used instead of benzoated lard.

7. Suppositoria Belladonnæ. Liquid extra 1·7 millilitres; oil of theobroma, q.s. to make twelve. *Strength.* Each contains 0·001 grm. (about $\frac{1}{64}$ gr.) of the alkaloids.

Atropina. Atropine. *Synonym.* Atropia. $C_{17}H_{23}NO_3$

Source. An alkaloid obtained from Atropa belladonn and other plants of the order Solanaceæ.

Characters. Colourless acicular crystals. *Solubility,* 1 in 500 of cold, 1 in 58 of boiling water, 1 in 1 of chloroform, 1 in 3 of alcohol (90 per cent.), 1 in 30 of ether, 1 in 52 of glycerin, and 1 in 15 of oleic acid.

Composition.—It consists of the alkaloid tropine, which is both a nitrogenous base and an alcohol, combined as an ethereal salt with aromatic acid, tropic acid. Atropine is optically inactive hyoscyamine, containing lævohyoscyamine and dextrohyoscyamine in equal proportions.

Incompatibles. Caustic alkalies decompose it.

Dose, $\frac{1}{200}$ to $\frac{1}{100}$ gr.—0·3 to 0·6 milligrm.

Preparation.

Unguentum Atropinæ. Atropine, 2; oleic acid 8; prepared lard, 90.

In India prepared suet should be employed instead of prepared lard.

Atropinæ Sulphas. Atropine Sulphate. $(C_{17}H_{23}NO_3)_2H_2SO_4$.

Source. It may be obtained by neutralizing atropine with diluted sulphuric acid.

Characters. Nearly colourless, crystalline substance. *Solubility.*—2 in 1 of water, solution neutral; 1 in 4 of alcohol (90 per cent.).

Dose, $\frac{1}{200}$ to $\frac{1}{100}$ gr.—0·3 to 0·6 milligrm.

Preparations.

1. **Lamellæ Atropinæ.**—Discs containing in each atropine sulphate, $\frac{1}{5000}$ gr. (0·013 milligrm.); gelatin and glycerin, $\frac{1}{50}$ gr. (1·3 milligrm.)

2. **Liquor Atropinæ Sulphatis.** Atropine sulphate, 1; distilled water, 100. *Strength.* 1 per cent., or 1 gr. of the sulphate in 110 ♏, 1 grm. in 100 millilitres.

Dose, ½ to 1 m. - 3 to 6 centimils.

ACTION.

The actions of belladonna and atropine are the same.

External.—Atropine placed by itself upon the unbroken skin cannot be absorbed, but rubbed in with substances which are absorbed, such as alcohol, glycerin, or camphor, or applied to a broken surface, it paralyses the terminations of the sensory nerves, especially if pain is present. It is thus a local **anæsthetic** and an **anodyne**. These are its chief actions; but to a much less extent it locally paralyses the terminations of the motor nerves, first contracts and then dilates the vessels, and renders the secretions of the skin less active.

Internal. *Gastro-intestinal tract.*—It will be convenient to describe the effects of belladonna on all secretions when speaking of its action on nerves, and we need not mention here its influence on the muscular coat of the intestine, for that is secondary to its action on the nervous system.

Blood.—Atropine is quickly absorbed, but does not affect the blood. Its main action is on the nervous system, and that must be considered in detail.

Secretory nerves. The activity of the **peripheral terminations of all the secretory nerves** in the body is, as far as we know, **depressed**, so that the secretions of those glands, whose activity is essentially regulated by their nerve supply, are markedly dimimarked, while the secretions of other glands are li altered.

Mouth.—Even small doses of atropine ma the **mouth dry** from lack of saliva and muc In health secretion of submaxillary saliva alwa follows stimulation of the chorda tympani nerv and, as is well known, this is due to the fact th this nerve is the secretory nerve for this gland, an not to any vascular dilatation. If atropine be giv to an animal, stimulation of the chorda no long causes an increased flow of saliva, however close the gland the nerve is excited, the reason being th atropine has paralysed the terminations of the chor tympani. In the same way the terminations of th secretory nerves of the other salivary glands and th mucous glands are paralysed, and hence the mout is dry, because normal impulses cannot reach th cells of the glands.

Stomach, liver, and intestines.—Atropine has n marked effect on the secretions of these organs.

Sweat glands.—Atropine paralyses the terminations of the nerves in the sudoriparous glands. Thu it causes the **skin** to become **dry**.

Kidneys.—Atropine has no direct effect on th secretion of urine.

Bronchial mucous membrane.—The secretion **bronchial** and **tracheal mucus**, like that of th mouth, is **diminished**.

Mammary gland.—Belladonna is used to inhibi the secretion of active mammary glands, but experiments on animals have not shown that it has any great influence in this direction.

Sensory nerves.—It has already been mentione that belladonna rubbed into the skin depresses the function of the terminations of the sensory nerves. It does the same when given by the mouth, but its action on sensory nerves—that is to say, its anæsthetic and anodyne action—is very inferior to that on the secretory nerves, and is not powerful enough as atropine to relieve pain when given internally. It is only used as a local anodyne.

Voluntary muscles and their nerves. Voluntary muscles are quite unaffected even by toxic doses of atropine; towards the end of a case of belladonna poisoning the motor nerves are slightly paralysed.

Involuntary muscles and their nerves. If atropine in small doses is given to animals, it is observed that the bowels are relaxed, and vomiting takes place. On the other hand larger doses stop peristalsis. These results are almost certainly due to **paralysis** of some of the numerous **nerve endings** distributed to the stomach and intestines.

All involuntary nerve terminations, as those of the muscles of the bladder, ureters, urethra, vesiculae seminales, uterus, and vagina, are **paralysed** like those in the intestinal muscles.

The eye and its nerves. Atropine acts only on the terminations of the nerves in the involuntary muscles of the eye. If it be dropped into the eye or given by the mouth, the **pupil dilates widely**, and cannot be made to contract by stimulation of the third nerve. That this dilatation is not due to any marked action on the muscular fibres of the iris themselves is shown by the fact that the atropinized pupil will contract if the muscle itself be stimulated. Therefore it must be that the **terminations of the third nerve** in the iris **are paralysed**. The ending of this nerve in the ciliary muscle is affected in the same way, and consequently **accommodation is paralysed**. It is certain that this mydriasis and defective accommodation is in no part central, as is the contraction of the pupil produced by opium. So strong is the local action of belladonna, that if atropine be dropped into the recently excised eye the pupil will dilate. When the third nerve is cut the pupil dilates, and if after this atropine be dropped into the eye it dilates still further. From this and other reasons we lea that atropine also stimulates the terminations of t sympathetic in the iris; but this action is compar tively slight, the chief is the tonus of the radiati fibres causing dilatation when the circular are par lysed. The intra-ocular tension is increased by lar doses. There is, as a result of the paralysis of t ciliary muscle, disturbance of vision. Atropine do not act on the pupils of birds.

The heart and its nerves.—The main action atropine is **to paralyse the terminations of the vag** in the heart, and consequently the **pulse is rendere** **more rapid,** and cannot be slowed by strongly sti lating the vagus. If the rate of the heart has be lowered by muscarin, which can be shown to have local stimulating influence on the terminations the vagus in the heart, the application of atropin renders the heart quick again, the two drugs bei in their effect on the heart, exactly antagonistic. Th quickening of the pulse from inhibition of the vag cardiac terminal filaments is the chief action of atr pine on the heart, but the following minor action must be noticed. The vagus centre and the trunk the nerve are also depressed, but to a much less extent Before the pulse is quickened it is occasionally slow for a short time by atropine; this is probably owi to a brief excitation of the vagus centre. Some authorities believe that part of the quickening of the pulse is due to a slight stimulation of the cardiac accelerator nerves, in the same way as we have seen that the sympathetic fibres in the iris ar excited; but if the accelerator nerves are stimulated, this stimulation is quite subsidiary to th important paralysis of the vagal terminations. Although the **pulse** is quickened by belladonna, its **force is not diminished.** Toxic doses abolish th function of the cardiac muscle, and the heart stops in diastole.

Vaso-motor system and its nerves.—After a considerable dose of belladonna the **skin is flushed**, and a scarlatiniform erythematous rash may be present in belladonna poisoning. It is thus obvious that such a dose of belladonna relaxes the peripheral vessels. The exact cause of this has not definitely been made out, but it is extremely probable that it is largely a peripheral action, quite harmonizing with the peripheral action we have seen atropine to have on the involuntary muscles of the intestines, eye, and heart: that is to say, the vaso-constrictor nerve filaments supplying the arterioles are paralysed, and consequently the vessels dilate. The action of atropine on the medullary vaso-motor centre is more marked than that on the cardiac medullary centre; but it is the same, the centre first being stimulated, and then depressed. This primary stimulation is sufficient to overcome the tendency of the peripheral vessels to dilate, so that belladonna at first contracts them; and as this stage of contraction lasts well into the period during which, owing to paralysis of the vagal terminations, the heart is accelerated, the **blood-pressure rises** considerably; **subsequently it falls**, the fall being due to the depression of the vaso-motor centre and the peripheral action of belladonna on the vessels, causing their wide dilatation. Ultimately, when the heart itself is paralysed, the blood-pressure is very low. The spinal vaso-motor centres are acted on as powerfully and in the same way as the medullary centre.

Respiration and its nerves. Here also belladonna **paralyses peripheral nerve-filaments**, in this case those of the vagus in the bronchial tubes. Both the afferent and efferent pulmonary vagal fibres are affected. The result is that the **muscular coat** of the bronchial tubes is **relaxed**, and that the secretions (the activity of the afferent fibres being depressed) do not irritate the nerves so much as before,

and therefore cough is lessened. It will be remem bered that the quantity of bronchial secretion diminished. The medullary and spinal respirator centres are influenced precisely as the vaso-motor that is to say, they are first stimulated, and so th respirations are quicker and deeper, then large dos paralyse them, and the breathing is slow and shallow The patient becomes asphyxiated, and this contr butes to the result in a fatal case.

Temperature. This is decidedly **raised** by tox doses of belladonna it may be four degrees Fahrenhe or more). This rise is independent of the blood pressure and of the diminution of perspiration. It said that heat-production is greatly exaggerated. Th heat-loss is also increased, probably because the flushing of the skin leads to a greater loss by radiation.

Spinal cord.—Except for the action on the vaso-motor and respiratory spinal centres, belladonna has little influence on the spinal cord in man, but it ha a well-marked tetanizing effect in frogs. It is said slightly to increase and afterwards diminish general **reflex excitability.**

Cerebrum.—A considerable dose of belladonna causes **delirium,** showing that the higher centres are stimulated. Generally the stimulation takes plac incoordinately. That it is powerful is indicated by th fact that in poisoning by belladonna the delirium will last for a long while. The subsequent quietude is not more than the exhaustion of the cerebrum from th continued delirium will explain. Belladonna rarely, if ever, produces genuine coma. Other symptoms that may be observed with large doses, and which ar probably due to disorder of the brain, are visions, sta gering gait, giddiness, and occasionally convulsions.

Elimination. Atropine is probably eliminated entirely by the kidney.

It will be seen that the **dominant action** of belladonna is to **depress** the activity of the terminations of nearly **all varieties of nerves.** In addition, it **first** stimulates and **then depresses** the **three great medullary centres,** and it is a deliriant. A summary of its effects on man will be given under the heading of Toxicology.

Children may take considerable doses of belladonna without any symptoms of poisoning.

Pigeons and rodents are peculiarly insusceptible to it.

The action of atropine on secretion, the heart, and pupil is due to lævohyoscyamine, dextrohyoscyamine having little action on these; on the other hand, the action of atropine on the spinal cord of frogs is due to dextrohyoscyamine.

THERAPEUTICS.

External. — Belladonna is used externally to relieve all sorts of pain — for example, that of neuralgia, pleurodynia, and chronic osteo-arthritis. Chloroformum Belladonnæ, B. P. C. (the root is extracted with chloroform), diluted with a little olive oil, or the liniment is excellent for these purposes. Glycerinum Belladonnæ (B. P. C.) soothes the pain of acute inflammations. This, or the plaster, or the ointment, is much used to prevent the secretion of milk in women who do not for any reason nurse their infants, but it must be remembered that the plaster is sufficiently strong to produce erythema and general toxic symptoms in those especially susceptible. Pruritus and local sweating of various parts of the body, especially the feet, may sometimes be stopped by the frequent application of belladonna liniment. A lamella, or a solution of the same strength (atropine sulphate 4 gr. (25 centigrms.), boric acid 5 gr. (30 centigrms.), water 1 fl. oz., 30 mils), will dilate the pupil for ophthalmoscopic examination. Atropine is often used in ophthalmic practice to paralyse the movements of the iris and ciliary mus to break down adhesions, and to prevent the format of contractions of the iris (see Homatropine, p. 3

Internal. *Alimentary canal.* Atropine has casionally been employed to check salivation, a some use it to overcome constipation and colic. T extract is then given, and is commonly combin with some purgative in a pill. Dry extract belladonna may be ordered with opium as a pill patients suffering from appendicitis or peritonitis, operation is inadvisable; as it is given several tim a day, a large amount is taken, and this, as alrea explained, probably paralyses intestinal movemen and so aids the opium.

Skin.—Atropine sulphate ($\frac{1}{100}$ gr., 0·6 milligrm injected subcutaneously, or one or two minims of t Liquor Atropinæ Sulphatis by the mouth, will som times arrest sweating, and this treatment may succee with the night sweats of phthisis.

Circulation. There are many cases of hea disease in which belladonna may advantageously b combined with other drugs. Whenever we wish t empty the ventricle completely it is useful, for it w be remembered that it increases the rapidity of th heart without diminishing the force. But its greate value is to remove cardiac pain and distress, which i often does most effectually. It may be convenient applied as a plaster over the cardiac region, or it ma be given internally, usually as the tincture. A sub cutaneous injection of atropine is useful for chloro form poisoning.

Respiration. As belladonna relaxes the muscular coat of the bronchial tubes it is of great value in spasmodic affections of the respiratory passage Thus, of all the numerous drugs that have been give for whooping-cough, it is one of the best. It is also very useful in asthma, and in bronchitis with asthma-like paroxysms; in the last-named disease its powerful stimulation of the respiratory centre and its capability of diminishing the secretion will, in properly chosen cases, render it particularly valuable. It is generally given as the tincture, and combined with other drugs. A useful linctus contains tincture of belladonna 3 ♏ (18 centimils), vinegar of squill 5 ♏ (30 centimils), syrup of tolu 10 ♏ (6 decimils), glycerin to 1 fl. dr. (4 mils).

Genito-urinary diseases.—Belladonna is one of the favourite remedies for the nocturnal incontinence of children, and it occasionally overcomes this trouble in adults when it is not due to organic disease. Its power of relieving the spasm of involuntary muscle is well shown in the effectual manner in which the very painful vesical spasm which accompanies calculus, cystitis, and prostatitis may be benefited by it. It may be given internally, or applied as a plaster to the perinæum.

Atropine combined with strychnine has been injected subcutaneously to diminish the craving for alcohol. Atropine has also been tried in many nervous diseases, but without any good results.

TOXICOLOGY.

If a person takes a moderate dose of belladonna he soon experiences dryness of the mouth and throat, and as the food, therefore, cannot be properly lubricated, there is difficulty of swallowing; the pulse may at first be a little slower than usual. The pupil is dilated; accommodation is defective, and vision blurred. The skin feels dry. If the dose has been a large one these symptoms all come on quickly; the conjunctiva and face, and perhaps other parts of the skin, are flushed, and the rate of the pulse is greatly increased, it may even be doubled. The patient staggers, feels giddy, and reels when he walks, the head soon becomes very hot, the skin still more flushed, the [illegible], and there may be a uniform erythematous rash. The temperature is often raised, the respirations are slow and [illegible]. The pupils are very widely dilated. By this time the patient is quite delirious. There may be paralysis, but this is not common, and sometimes he complains of a frequent desire to micturate, although he is unable to pass any urine. Death

takes place from cardiac failure combined with asphyxia. P
mortem. The organs are all in a state of venous congesti
which is due to the asphyxia. If recovery takes place
patient may have no recollection of his illness.

Treatment.—Give emetics (p. 115) or wash out the stoma
Stimulants and pilocarpine or morphine subcutaneously. E
ploy artificial respiration and hot bottles, and give strong cof
per rectum.

ANTAGONISM.

The antagonism between atropine and morphine has alre
been discussed (*see* p. 377). It is clear that as *pilocarp*
stimulates the terminations of the secretory nerves in t
salivary and sweat glands, and also stimulates the terminatio
of the third nerve in the iris and ciliary muscle it is a diaph
retic, a sialogogue, and a myotic, and in these respects a
antagonistic to atropine. *Morphine* also causes contraction
the pupil and spasm of the ciliary muscle by stimulation of t
terminations of the third nerve, and it depresses the respirato
centre almost from the beginning. In these points it is a
antagonist to atropine.

Homatropinæ Hydrobromidum. Homatro
pine Hydrobromide. $C_{16}H_{21}NO_3,HBr$.

SOURCE.—It is the hydrobromide of an alkaloid prepa
from tropine.

CHARACTERS.—A white crystalline powder or aggregati
of minute trimetric crystals. *Solubility*, 1 in 6 of water, 1 i
18 of alcohol (90 per cent.).

Dose, $\frac{1}{64}$ to $\frac{1}{32}$ gr.—1 to 2 milligrms.

Preparation.

Lamellæ Homatropinæ. Discs of gelatin a
glycerin each weighing [illegible] gr. (2·1 milligrms.) a
containing [illegible] gr. (0·65 milligrm.) of homatrop
hydrobromide.

ACTION AND THERAPEUTICS.

Homatropine has an action exactly similar, as far
as we know, to that of atropine. It is only used to
dilate the pupil in ophthalmic practice, the advantage
over atropine being that the dilatation produced by
homatropine passes off in a quarter of the time. It

may be applied either as a solution (4 gr. of the hydrobromide to 1 fl. oz. of distilled water) or as the lamella. Sometimes a solution in castor oil is used, for it is less likely to be washed out by the tears, but it may be rather irritating.

STRAMONIUM.

Stramonii Folia. The dried leaves of *Datura Stramonium.*

CHARACTERS. Ovate, petiolate, 10 to 15 centimetres long, dark green, wrinkled, unequal at base, margin sinuate dentate, and apex acuminate. Odour slightly narcotic. Taste saline and bitter. *Resembling stramonium leaves.* — Belladonna leaves less wrinkled; hyoscyamus leaves, hairy.

COMPOSITION. Chiefly hyoscyamine with a little atropine, but the proportion of alkaloids is inconstant. The total alkaloids are sometimes called daturine.

Preparation.

Tinctura Stramonii. – Stramonium leaves, 2; alcohol (45 per cent.), 10. Percolate.

Dose, 5 to 15 m. 3 to 10 decimils.

ACTION.

The physiological action of stramonium is almost the same as that of belladonna; the differences being that stramonium relaxes the muscular coat of the bronchial tubes more powerfully than belladonna, it may cause the heart to be a little irregular, and is generally thought to be more active than belladonna.

THERAPEUTICS.

There is no reason why stramonium should not be employed for the same purposes as belladonna, but it is rarely used, except in cases of asthma to relieve the spasm of the bronchial tubes. For this it is very valuable. Cigarettes of the leaves may be smoked, or the drug may be given internally. The following powder, which gives off dense fumes when burnt, affords great relief for asthma:—leaves of **Datura Stramonium and of Datura Tatu** Cannabis Indica, and Lobelia Inflata, all in powd and of each 320 gr. (21 grms.); nitre in powder, 1 (32 grms.); eucalyptus oil, 30 m (2 mils). M thoroughly. Himrod's, Bliss's and other "cures" asthma are of a similar composition.

DATURA LEAVES.

Daturæ Folia. The dried leaves of *Datu fastuosa* and of *Datura metel.*

Characters.—Ovate, acuminate, with long petioles a sinuate-dentate margins. The larger are about 20 centimetr long and 13 centimetres wide. Brown or yellowish gre Characteristic odour and bitter taste.

Action and Therapeutics.

These leaves have the same action, and ma be used for the same purposes, as those of *Datur stramonium.* Preparations of them may also be use instead of belladonna. Employed chiefly in Indi and the East.

DATURA SEEDS.

Daturæ Semina.—The dried seeds of *Datur fastuosa.*

Characters.—Yellowish brown. Wedge shaped; rounded thickened, furrowed, wavy margins. Strongly compress laterally, about 5 millimetres broad and 1 millimetre thick. The testa is finely pitted and reticulated.

Preparation.

Tinctura Daturæ Seminum. 1 in 4 of alcohol (60 per cent.). Percolate.

Dose, 5 to 15 m.—3 to 10 decimils.

Action and Therapeutics.

These seeds have the same action as those of *Datura stramonium.* They are employed chiefly in India and the East.

HENBANE.

Hyoscyami Folia. Hyoscyamus Leaves. *Synonym.* Henbane Leaves. The leaves of *Hyoscyamus niger*. Collected [illegible] flowering plants and dried.

CHARACTERS.—Varying in length up to 25 centimetres, without stalks, alternate, exstipulate, triangular ovate or ovate oblong, pale green, glandular hairy particularly underneath. Branches subcylindrical, and also glandular hairy. Odour strong, heavy when fresh. Taste bitter, slightly acrid. The juice dropped in the eye dilates the pupil.

COMPOSITION.—The chief constituents are (1) *Hyoscyamine*, $C_{17}H_{23}NO_3$, an alkaloid. Characters: snow-white masses of acicular crystals. *Solubility*, 1 in 120 of water, freely in alcohol. It is also contained in belladonna, stramonium, and many other plants of the Natural Order *Solanaceæ*. It, like atropine, with which it is isomeric, consists of tropic acid and tropine. Lævohyoscyamine and dextrohyoscyamine both exist. There is in commerce an amorphous impure hyoscyamine, which is a brown fluid having a disagreeable odour. As it is much cheaper than the crystalline alkaloid it is often used. Probably it contains no hyoscyamine, but only hyoscine. (2) *Hyoscine*, $C_{17}H_{21}NO_4H_2O$. Characters: a white crystalline alkaloid. It is isomeric with a powerful mydriatic alkaloid, atroscine, which consists of oscine and atropic acid. (3) A poisonous oil.

INCOMPATIBLES.—Vegetable acids, silver nitrate, lead acetate, alkalies.

Preparations.

1. Extractum Hyoscyami. An alcoholic (70 per cent.) extract.

Standardised to contain 0·3 per cent. of the alkaloids of hyoscyamus leaves.

This is Extractum Hyoscyami Viride, B. P. 1898.

Dose, 2 to 8 gr.—12 to 50 centigrms.

2. Pilula Colocynthidis et Hyoscyami. Extract of hyoscyamus, 1; compound pill of colocynth, 2; water, q. s. (*see* Colocynth).

Dose, 4 to 8 gr.—25 to 50 centigrms.

3. Tinctura Hyoscyami.—Hyoscyamus leaves, 1; alcohol (70 per cent.), 10. Percolate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

Hyoscinæ Hydrobromidum. Hyoscine Hydrobromide. $C_{17}H_{21}NO_4,HBr,3H_2O$. *Synonym.* Scopolam hydrobromide. The hydrobromide of an alkaloid, hyos or scopolamine, obtained from various plants of the nat order Solanaceæ.

CHARACTERS. Colourless, small, transparent, rhom crystals; slightly bitter taste. *Solubility.* 1 in 4 cold wa 1 in 13 alcohol (90 per cent.).

Dose, 1/200 to 1/100 gr. 0·3 to 0·6 milligrm. Usua given subcutaneously.

Hyoscyaminæ Sulphas. Hyoscyamine Su phate. $(C_{17}H_{23}NO_3)_2H_2SO_4,2H_2O$. The sulphate of an alkal hyoscyamine, obtained from various plants belonging to t natural order Solanaceæ.

CHARACTERS. A crystalline, deliquescent, odourless, l powder. *Solubility.* 2 in 1 water; 1 in 4½ alcohol (90 cent.).

Dose, 1/200 to 1/100 gr. 0·3 to 0·6 milligrm.

Both hyoscine and hyoscyamine salts are usually giv subcutaneously. Convenient discs of both of them, to be d solved before use, are prepared.

ACTION.

That the action of hyoscyamus is almost identical with that of belladonna and stramonium is not surprising when we remember the close resemblance of these drugs in alkaloidal composition. The following are the chief points of difference. **(1)** Hyoscyamus contains **hyoscine** in minute quantities. This is a powerful **cerebral** and **spinal sedative**, and therefore the excitation and delirium occasioned by belladonna are not so evident when hyoscyamus is given; indeed, that may, owing to the hyoscine in it, distinctly depress the higher functions of the brain. The heart is not quite so powerfully affected by hyoscyamus as by belladonna, for hyoscine has a comparatively feeble cardiac influence. Still it is, of course, affected by the hyoscyamine, which acts like atropine. **(2) Hyoscyamus increases the peristaltic contractions of the intestines more powerfully than** belladonna, and at the same time it is more efficient in relieving the griping of other purgatives. (3) Hyoscyamus has a more markedly sedative action on the urinary unstriped muscle than belladonna. (4) Hyoscine diminishes intra-ocular tension; therefore hyoscyamus does not affect this so much as belladonna.

Pure atropine and pure hyoscyamine have precisely the same actions, but hyoscyamine is twice as powerful in its action on the nerve-endings in the salivary glands, heart, and pupil.

THERAPEUTICS.

Hyoscyamus might be used for the same purposes as belladonna, but is chiefly employed in combination with purgatives to diminish griping. It is also given to relieve vesical spasm in calculus, cystitis, and prostatitis, usually with other urinary sedatives, as buchu, uva ursi, or benzoic acid if the urine is alkaline. It will be noticed that the doses of hyoscyamus are larger than those of the corresponding preparations of belladonna.

Hyoscine, often called scopolamine, and hyoscyamine may be employed as cerebral depressants, and are used in acute mania, delirium tremens, senile delirium, and insomnia, sometimes with good results. They are often given in asylum practice. Both must be given carefully, as the activity of different specimens varies, and fatal results have followed their use. They should never be employed if the patient is weak. Hyoscine is most used, and is usually given subcutaneously. A single dose should rarely exceed [illegible] gr. (·6 milligramme) of the hydrobromide. Chorea, paralysis agitans, and other convulsive diseases have been treated with it, but the convulsions always recur when it is discontinued, and an occasional dose is sometimes useful in paralysis agitans. Combined with morphine it is largely given to diminish sensibility before a gen anæsthetic and in labour.

Duboisinæ Sulphas.—(Not official.)

The sulphate of a mixture of alkaloids obtained from leaves of *Duboisia myoporoides*. Duboisine consists ch of hyoscine and hyoscyamine (see p. 398). Its actions like but more powerful than those of atropine, and d containing [illegible] of a grain ([illegible] mgrm.) are used to dilate pupil.

GRINDELIA.

Grindelia.—The dried leaves and flowering tops *Grindelia camporum*

CHARACTERS.—Stems slender, yellow, smooth. Lea about 4 centimetres long, blunt, sessile, pale green, ri brittle, coriaceous. Flower heads yellow, hard, resino Odour aromatic. Taste aromatic and bitter.

Preparation.

Extractum Grindeliæ Liquidum.—Grinde 10; sodium bicarbonate, 1; distilled water, 5; alcoh (90 per cent.) to produce 10. Percolate.

Dose, 10 to 20 m. 6 to 12 decimils.

ACTION AND THERAPEUTICS.

In small doses grindelia is a mild stomachic an cardiac sedative, but its main action depends upor the fact that in its excretion by the bronchial mucou- membranes it acts as an expectorant, and also, lik atropine, relaxes the muscular coat of the bronchial tubes, and this probably explains its efficacy in asthma. Two or three doses of twenty or thirty minims of the liquid extract (in milk to prevent the resin, which is precipitated by excess of water, adher ing to the vessel) given every twenty minutes will often allay the paroxysms of asthma. Between the attacks this dose should be taken thrice a day. The same quantity may with advantage be added to mixtures prescribed for chronic bronchitis, for then not only is grindelia an expectorant, but it relieves the asthma-like paroxysms which so often accompany bronchitis. It is very bitter; its taste is best concealed by Spiritus Chloroformi.

In America cloths soaked in a lotion of 1 fl. dr. of the fluid extract to 6 fl. oz. of water are applied to the skin for the dermatitis caused by *Rhus toxicodendron*, the poison ivy. The same lotion is used in burns, and as an injection in gleet and leucorrhœa.

CANNABIS INDICA.

Cannabis Indica. Indian Hemp. The dried flowering or fruiting tops of the pistillate plant of *Cannabis sativa*, from which the resin has not been removed. India.

CHARACTERS. In compressed dusky green masses, consisting of the branched upper part of the stem bearing the remains of flowers, leaves, and a few ripe fruits, and cemented by adhesive resin. The upper leaves are simple, alternate, 1–3-partite, the lower opposite and digitate. The fruit is one-seeded, supported by a bract.

COMPOSITION.—(1) The active constituent is a resin to which many names have been given; that best known is cannabin, its active principle is cannabinol; (2) a volatile oil, consisting chiefly of a sesquiterpene, cannabene; (3) choline.

INCOMPATIBLE.—Water, which precipitates the resin.

Preparations.

1. Extractum Cannabis Indicæ.—Alcoholic. **Dose, ¼ to 1 gr. 16 to 60 milligrms.**

2. Tinctura Cannabis Indicæ. Extract, 1; alcohol (90 per cent.), 20. Simple solution. **Dose, 5 to 15 m. 3 to 10 decimils**—should be triturated with mucilage before water is added, as this precipitates the very bulky resin.

Tincture of Indian Hemp is contained in Tinctura Chloroformi et Morphinæ Composita.

Synonyms.—Haschisch is a confection of the drug. Gunjah, or ganga, is the dried flowering tops of the cultivated female plants which are coated with resin. Churrus or charas is the resin scraped off the leaves. Bhang is the dried leaves; in some provinces it means powdered ganga made into a drink. Ganga and charas are often smoked like tobacco.

ACTION.

External.—None is known.

Internal.—The effects of cannabis indica vary very much in different people. This is partly due to the uncertain strength of the preparations of the drug, and partly to individual peculiarities, but generally the symptoms are somewhat as follows. After some time, usually from half an hour to two or three hours, there is a pleasurable sensation of mild intoxication; the patient is particularly gay, joyous, and pleased with everything; he will laugh and smile on the slightest provocation, and is himself able to say sharp, witty things. Pleasant ideas flit through his mind with wonderful rapidity, so that time seems to him much extended. Generally the ideas are quickly forgotten, but sometimes the memory of them remains after recovery. The eyes are bright, the pupils may be dilated. The limbs feel heavy, and there is a marked lowering of general sensibility so that he scarcely feels a severe pinch; this may pass on to complete anæsthesia. There may be headache. After a time sleep, which is often accompanied by delightful dreams, comes on. The drug is frequently taken in the East to produce the early pleasurable symptoms, and, in moderation, it causes no harm. Very few take it to excess, but in them it leads to loss of appetite and strength, trembling, and insanity. Cannabis indica is reputed to occasionally produce sexual excitement, but this is incorrect. The most constant effect is that time seems prolonged. Minutes appear to be days. Large doses given to a dog only made him sleepy, and uncertain on his legs, but he appeared contented and pleased. Much the same results followed when a monkey was made to inhale the smoke daily for 181 days.

THERAPEUTICS.

It has been given with success in migraine and neuralgia, but it very often fails to afford relief. Its use as an hypnotic has been discarded. The tincture is very difficult to prescribe, because of the voluminous precipitate of resin which falls on the addition of water. Mucilage must be used to suspend it, and the taste should be covered with spirit of chloroform.

CAFFEINE.

Caffeina. Caffeine. $C_8H_{10}N_4O_2,H_2O$. *Synonyms.* Theine. Guaranine.

SOURCE. An alkaloid usually obtained from the dried leaves of *Camellia thea*, common tea, or from certain other plants.

CHARACTERS. Colourless, silky, inodorous, acicular crystals. *Solubility.* 1 in 80 of cold water, 1 in 1 of boiling water, 1 in 40 of alcohol (90 per cent.), 1 in 400 of ether, 1 in 7 of chloroform. The solubility of caffeine is perfect in cold water, if for each grain of caffeine ½ a grain of sodium salicylate is added. The addition of alcohol as in tinctures or spirit of chloroform does not impair the solubility. Tea contains 3 to 5 per cent. (hence the name theine). Coffee, 1·3 per cent. (coffee leaves contain much more). Guarana, the seeds of *Paullinia cupana*, 5 per cent. (hence the name guaranine). Maté (Paraguay tea, the leaves of *Ilex paraguayensis*), 0·5 per cent. Kola nut (which is used as a beverage in Africa), 3 per cent.; this is the fruit of *Sterculia acuminata*. Youpon (Apalache tea) also contains caffeine. Most of these substances also contain theobromine. Caffeine is trimethyl xanthine, theobromine is dimethyl xanthine, and both can be prepared synthetically from xanthine. It is a feeble alkaloid, its salts being very liable to split up.

INCOMPATIBLES. Potassium iodide, salts of mercury, and tannic acid.

Dose, 1 to 5 gr. -6 to 30 centigrms.

Caffeinæ Citras.—Caffeine Citrate. $C_8H_{10}N_4O_2$, $C_6H_8O_7$.

SOURCE. Mix caffeine with citric acid, moisten with distilled water and dry.

CHARACTERS.—A white, inodorous powder. A feeble salt easily splitting up. Taste and reaction acid. *Solubility.* 1 in 32 of water, 1 in 22 of alcohol (90 per cent.), 1 in 10 of a mixture of 2 of chloroform and 1 of alcohol (90 per cent.) With 1 in 10 of water, it forms a clear, syrupy, supersaturated solution, but directly the mixture is stirred the caffeine citrate is precipitated; then, if more water is added, this precipitate re-dissolves. This peculiarity in the solubility of caffeine citrate often leads to mixtures being prescribed in which the caffeine citrate is precipitated, but then it can be suspended in mucilage. If caffeine citrate is prescribed with sodium salicylate, a very bulky precipitate forms.

INCOMPATIBLES.—The same as of caffeine.

Dose, 2 to 10 gr. 12 to 60 centigrms.

Caffeinæ Citras Effervescens. Effervescing Caffeine Citrate.

SOURCE.—Mix citric acid, tartaric acid, caffeine citrate. Also mix sodium bicarbonate, refined sugar. Incorporate the two mixtures, heat to 100°C. When the mixture is granular pass through a sieve, and dry at a temperature not exceeding 55°C.

Dose, 60 to 120 gr.—4 to 8 grms.

ACTION.

External.—None.

Internal.—*Alimentary canal.*—Excessive tea-drinking may cause indigestion, but this is probably induced by the tannin in the tea, and not by the caffeine. The teeth of tea-tasters are liable to decay. Coffee is, with some persons, slightly laxative; it is not known to what ingredient this is due.

Heart. Caffeine is freely absorbed. It produces no change in the blood. Moderate doses **increase** the **rate** of the cardiac beat, due to stimulation of the cardiac muscle. The diastole is shortened. Large doses cause the heart to become irregular; caffeine acts much less powerfully on the heart than digitalis. In man the heart is occasionally at first slowed from stimulation of the inhibitory apparatus, and this may be the cause of the palpitation experienced by some who take too much tea.

Vessels.—Caffeine causes first a constriction and then a dilatation of the arterioles of the body, and this is due principally to its action on the vaso motor centre and slightly to its action on the muscular coat. During the dilatation the pressure remains raised owing to cardiac action.

Respiration. In animals the rate and extent of breathing are increased by caffeine from stimulation of the medulla.

Nervous system.—It is well known that tea and coffee stimulate the cerebrum. This is due to the caffeine in them. The patient becomes wakeful, the mental activity and capability for work are increased, the reasoning powers being quite as much affected as the imagination. In this respect the cerebral stimulation of caffeine differs from that of opium, and also in that the excitation is not incoordinate, nor is it soon replaced by sleep. The special senses are rendered more alert. Very excessive tea-drinking causes trembling of all the muscles of the body, and makes the patient extremely "nervous."

In man the spinal cord and muscles are very little affected by caffeine, but in some frogs the spinal cord is decidedly stimulated, and convulsions occur; in other species the muscles are thrown into a state of rigidity, which is clearly due to an action on the muscles themselves, for it follows the local application of caffeine to an isolated muscle, the fibres of which become white and opaque, the transverse striation disappears, and rigor supervenes. Sometimes the muscle curve is altered in character. In man the power to do muscular work is increased by caffeine. Motor and sensory nerves are uninfluenced in all animals.

Kidneys.—As caffeine first causes a contraction of arterioles, there may be a decrease in the urinary flow; but soon the renal vessels dilate, the renal cells are directly stimulated, and the flow of urine is increased—chiefly its fluids, but to a less extent its

solids. Thus caffeine is a good **local diuretic,**
theobromine is better, as there is with it no p
liminary contraction of the vessels, it is more pow
ful and does not cause sleeplessness.

Metabolism.—Many elaborate experiments h
been made upon the action of caffeine on tissue was
they are all of them inconclusive, most likely
has no effect. It increases the excretion of xanth
in the urine because it loses its methyl groups in
passage through the body; the increased urea som
times excreted is derived directly from the xanth
Toxic doses may cause a rise of temperature.

THERAPEUTICS.

Heart.—Caffeine has been most used in hea
disease. It is given when, as in aortic or mit
obstruction, a purely stimulant effect is desire
large doses, 3 or 8 grains (2 to 5 decigrms.) a day
caffeine, are often easily borne, and may be combin
with strychnine. It will not replace digitalis, for
somewhat quickens the heart, does not make
regular, and shortens the diastole. It is, on accou
of its diuretic action, especially valuable in cardi
cases in which there is dropsy. Tea and coffee are, i
some persons, liable to produce irregularity of th
heart.

Kidney.—Small doses of caffeine are powerfull
diuretic, and are therefore used in heart diseas
ascites, and pleuritic effusion. Their action is ofte
much aided by giving digitalis at the same tim
As the drug acts directly on the kidney, it should b
given cautiously in renal disease. Many patients s
soon become used to it, that at the end of a week i
has lost its power of producing diuresis.

Nervous system.—Occasionally it cures migraine,
but it is not so useful as phenazone or phenacetin.
A dose of the effervescing citrate in half a tumbler

water is a pleasant form in which to give caffeine this purpose.

It may be rendered sufficiently soluble for subneous administration by mixing it with a solution salicylate of sodium.

THEOBROMINE AND SODIUM SALICYLATE.

Theobrominæ et Sodii Salicylas. Na_2C_{14} N_4O_5. *Synonym.*—Diuretin.

SOURCE.—Obtained by combining sodium hydroxide, romine, and sodium salicylate. Should be preserved in ed amber-coloured bottles.

CHARACTERS.—A white amorphous powder. No odour. sweetish. Soluble in 1 part of water.

Dose, 10 to 20 gr. 6 to 12 decigrms.

ACTION AND THERAPEUTICS.

Theobromine (the chief principle in cocoa), often scribed as diuretin, is an excellent diuretic; it on the renal epithelium, and is most efficacious relieving œdema in diseases of the kidneys and rt, especially if digitalis is given at the same time. s said not to produce much depression, but it may sionally cause serious symptoms. Theobromine self may be given in cachets in doses of 1 to 5 gr. to 30 centigrms.). There are many salts of it the market, but the above official compound with ium salicylate is the best.

Guarana.—(Not official.)

Synonym.—Brazilian cocoa. The seeds of *Paullinia na.* Brazil. They are roasted, powdered, and made into iff paste with water and then dried.

CHARACTERS.—Cylindrical hard rolls of dried paste.

COMPOSITION.—The chief constituent is 2·5 to 5 per cent. affeine (*see* p. 405).

Dose, 15 to 60 gr. 1 to 4 grms.—in powder or sed in a cup of boiling water.

Preparation (B. P. C.).

Tinctura Guaranæ. Guarana in powder, 2
alcohol (60 per cent.), 100. Macerate.

Dose, 1 to 2 fl. dr.—4 to 8 mils.

ACTION AND THERAPEUTICS.

Although there is no reason to believe that gu ranine does not produce the same actions on th nervous system, heart, and kidneys as caffeine, yet is rarely used except for sick headaches, but in the cases it is sometimes of great service.

CLASS II. Vegetable Drugs acting chiefly on the Spinal Cord.

NUX VOMICA.

Nux Vomica. *Synonyms.* Poison nut. The drie ripe seeds of *Strychnos nux-vomica*. East Indies. The S Ignatius bean (*Str.* [illegible]) [illegible] different in shape [illegible] contains more strychnine.

CHARACTERS. Disc-shaped, 2 to 2½ centimetres in dia meter, 6 millimetres thick. Flat or concavo-convex. Marg rounded. On one surface a central scar, from which a ridge passes to the margin, and ends in a slight prominence. Externally ashen grey, glistening with short satiny hairs. Internally horny and slightly translucent. No odour. Taste extremely bitter.

COMPOSITION.—The chief constituents are—(1) *Strychnine* (*see* p. 409), 0·9 to 1·9 per cent. (2) *Brucine*, which is di-methoxyl-strychnine, $C_{23}H_{26}N_2O_4$, 0·9 to 1·5 per cent. Colourless prismatic crystals or pearly flakes. Very bitter, but less so than strychnine. *Solubility*, 1 in 3200 of cold water, freely in alcohol. It has the same action as strychnine, but is considerably less powerful and slower in its effects. Strong sulphuric or nitric acid gives a blood red colour. (3) *Igasuric acid*, with which the strychnine and brucine are united. (4) *Loganin*, an inert glucoside.

Powdered Nux Vomica, when used for official purposes other than the production of standardized preparations, must be adjusted, if necessary, by the addition of powdered Milk Sugar to contain 1·25 per cent. of Strychnine.

Dose, 1 to 4 gr.—6 to 25 centigrms.

Preparations.

1. **Extractum Nucis Vomicæ Liquidum.** Alcohol (70 per cent.). *Standardized to contain 1·5 per cent. of strychnine*, that is, 1½ gr. in 110 m.

Dose, 1 to 3 m. 6 to 18 centimils.

2. **Extractum Nucis Vomicæ Siccum.** The liquid extract is evaporated and diluted with calcium phosphate. *Standardized to contain 5 per cent. of strychnine.*

This is Extractum Nucis Vomicæ, B. P. 1898.

Dose, ¼ to 1 gr. 10 to 16 milligrms.

3. **Tinctura Nucis Vomicæ.**—Liquid extract of nux vomica, 5; water, 15; alcohol (90 per cent.), to produce 60. Mix. *Standardized to contain 0·125 per cent. of strychnine*, that is, 1·25 milligrms. in each millilitre, or $\frac{1}{14}$ gr. in 1 fl. dr.

This contains one half as much strychnine as in B. P. 1898.

Dose, 5 to 15 m.—3 to 10 decimils.

Strychnina.—Strychnine. $C_{21}H_{22}N_2O_2$.

Source.—This alkaloid is prepared from the seeds of nux vomica and other species of *Strychnos*.

Characters. Minute, colourless, odourless, trimetric prisms. Intensely bitter; can be tasted in a solution of 1 in 700,000 (but only to be tasted in weak solutions, as it is so poisonous). *Solubility.* 1 in 5760 of cold, 1 in 2500 of hot, water, 1 in 6 of chloroform, 1 in 150 of alcohol (90 per cent.). Gives no colour with nitric or sulphuric acids. Add to a crystal strong sulphuric acid, and then add a particle of potassium bichromate; a beautiful violet colour, passing to brown and green, is formed. *Resembling strychnine.*—Salicylic acid.

Incompatibles. Alkalies, iodides, bromides; the last are especially dangerous, for the precipitated bromide of strychnine falls slowly.

Impurity. Brucine, distinguished by tests

Dose, $\frac{1}{64}$ to $\frac{1}{16}$ gr. 1 to 4 milligrms.—in solution, or made in a pill with sugar of milk (to thoroughly divide it) and glycerin of tragacanth.

Preparation.

Syrupus Ferri Phosphatis cum Quinina Strychnina. —Each fl. dr. represents [illegible] gr. stry (see p. 193).

Dose, ½ to 1 fl. dr.— 2 to 4 mils.

Strychninæ Hydrochloridum. — Stry hydrochloride. $C_{21}H_{22}N_2O_2HCl,2H_2O$.

CHARACTERS. Small, colourless, trimetric prisms, readily effloresce in air; very bitter. *Solubility.* —1 water, 1 in 60 alcohol (90 per cent.).

Dose, $\frac{1}{64}$ to $\frac{1}{16}$ gr.— 1 to 4 milligrms.

Preparations.

1. Injectio Strychninæ Hypodermica. Strychnine hydrochloride, 0·75; distilled water. *Strength.*— 0·75 per cent.; ¾ gr. in 110 m.

Dose, 5 to 10 m.— 3 to 6 decimils.

2. Liquor Strychninæ Hydrochloridi. *onym.*— Liquor Strychninæ. Strychnine hyd 1; alcohol (90 per cent.), 25; distilled water to 100. *Strength.*— 1 per cent.; that is, 1 gr. in 110 1 grm. in 100 millilitres.

Dose, 2 to 8 m.—12 to 50 centimils.

ACTION.

External. Strychnine is a very powerful ant **septic.** Brucine is a local anæsthetic.

Internal. *Gastro-intestinal tract.*—Being in tensely bitter, nux vomica is a good **stomachic** increasing the vascularity of the gastric muco membrane, the secretion of gastric juice, and th movements of the stomach by its action on th mouth, just like calumba (*q.v.*), or any other bitter consequently it aids digestion and sharpens th appetite. It is a stimulant to the intestinal muscula coat, and by this means it **increases peristalsis**, an is therefore purgative.

Blood. Strychnine is absorbed into the blood and circulates as such. If blood is mixed with strychnine and shaken with air it contains more oxygen and less carbonic acid than it would have had the strychnine been absent; but there is no evidence that strychnine in small doses alters the oxidizing power of living blood.

Spinal cord. Strychnine causes **convulsions.** They are not cerebral, for they occur if the spinal cord is separated from the brain. They do not depend on excitation of the motor nerves or muscles, for they are absent in a limb the spinal anterior nerve roots of which are cut. They occur if the posterior nerve roots are cut, provided the proximal end is stimulated. Therefore they must be **spinal**; and this is proved by the fact that if all the vessels of the upper part of the spinal cord are ligatured just at their entry into the cord, so that this is the only part of the body deprived of its blood supply, and strychnine is injected into the blood, convulsions occur in all the muscles except those the nerves of which spring from the part of the cord which the strychnine cannot reach. Again, if an animal be convulsed by strychnine, and a probe be slowly passed down the spinal canal, the convulsions will gradually cease from above downwards. But a peripheral stimulus, particularly if sharp and sudden, so easily excites convulsions when strychnine has been given that we are justified in assuming that every convulsion is excited by a peripheral stimulus, and often so slight as not to be evident. Further, strychnine enormously exaggerates the conduction power of the cord in such a way that general convulsions reflexly follow a very slight local stimulus. It is believed that the precise part of the spinal cord stimulated to increased excitability by strychnine is that immediately on the afferent side of the anterior cornual cells.

When a muscle contracts, centripetal impulses go from it up afferent nerves, and these reinforce the inhibitory impulses going to the opposing muscles. Recent

research (Sherrington) shows that **strychnine rever**
in the cord these inhibitory impulses, making th
excitory. Usually we are unaware of these inhibit
impulses, but when they become excitory they
manifest, and especially so if strychnine has be
given, for then, as just mentioned, the excitabil
of the cord is heightened. The patient makes so
slight movement, which would normally be associat
with unappreciated inhibition of the extensors of t
spine, but strychnine converts these inhibitory in
powerful exciting impulses, with the result th
powerful contraction of the extensors takes pla
(opisthotonos). In the same way, an attempt to op
the jaw becomes a powerful contraction (lockjaw).

Muscles and Nerves.—Even with enormous dos
the muscles and afferent nerves are unaffecte
Towards the end of a case of poisoning the fun
tional activity of the motor end-organs is depresse
This is due to direct action on them, and occu
readily in some species of frogs.

Brain. The **convolutions** are quite **unaffected** b
ordinary doses, but large doses slightly stimulat
the cells of the motor area; but as in the cord,
here, normal unappreciated inhibitory impulses be
come powerfully excitory. Thus stimulation of th
very part of the motor area that would normally pro
duce, say, flexion of one hind limb now produce
strong extension of that limb. The centres in th
medulla, which are really the continuation upward
of the anterior cornua of the cord, are **powerfull**
stimulated, especially the **respiratory centre.** Th
vaso-motor centre is also considerably **excited**, an
chiefly for this reason the blood-pressure rises from th
very first. The cardiac centre is but slightly affected

Circulation.—Strychnine **stimulates the heart**
but whilst this is partly due to a direct action o
the heart, it chiefly results from the great **rise o**
blood-pressure. **This is caused by the contraction**

of the vessels all over the body, which is brought about first by the direct excitation by the strychnine of the medullary vaso-motor centre, and subsequently by its asphyxial stimulation, and also by the increased peripheral resistance which must occur from the frequent contraction of all the muscles. Strychnine also to some extent causes vascular constriction by direct stimulation of the muscle of the arterioles.

Respiration.—Respiration is rendered quicker and deeper because strychnine excites the spinal and medullary respiratory centres. The respiratory muscles are implicated in the general convulsions, with the result that the patient ultimately becomes asphyxiated owing to exhaustion of them, and to their prolonged contraction during the convulsive spasms. The heart continues to beat after death, which is entirely due to failure of respiration. The excessive muscular contractions occasionally cause a rise of temperature, but so rarely that often the loss of heat must be greatly increased.

Special senses.—Smell, hearing, touch, and sight are sharpened by strychnine. The field of vision, especially for blue, is said to be enlarged. All these effects are probably due to local action on the peripheral sense organs.

Elimination.—Strychnine is eliminated unchanged in the urine. It is excreted rather slowly, and therefore tends to accumulate in the system. Tolerance is never established. For a clinical account of strychnine poisoning *see* Toxicology.

Brucine and thebaine act like strychnine, but methylbrucine, methylthebaine, and methylstrychnine do not influence the cord, but paralyse the ends of the motor nerves like curare.

Strychnine acts on all animals in the main as on man, but some birds and guinea-pigs are less susceptible to it, for they absorb it slowly.

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THERAPEUTICS.

External.—Strychnine is so poisonous that use as an antiseptic would not be safe.

Internal.—*Gastro-intestinal tract.*—Tincture nux vomica is very largely given with excellent resu as a bitter stomachic and carminative, especially cases in which the feebleness of digestion is mer part of generally feeble health. A mixture of dilu hydrochloric acid, gentian, and nux vomica is of gre service in these cases. As the digestion improves t general health improves. Because of its power stimulate peristalsis, nux vomica is a valuable dr for cases of constipation in which the contract strength of the muscular coat of the intestine weak; usually this is part of a general weakness the whole body. The constipation of anæmia, whic can be very successfully treated by a pill of extra of nux vomica and iron sulphate, is a good instance of this variety of constipation.

Circulation. In cases of heart disease in whic digitalis is inadmissible, nux vomica and strychnin are excellent cardiac stimulants, and for this purpo they may be combined with caffeine. Patients almos dead from failure of the heart in the course of chroni cardiac disease may apparently be brought round b the subcutaneous injection of strychnine; but som doubt its efficacy.

Respiration.—Strychnine may be combined wit expectorants as it stimulates the respiratory centre and it is extremely serviceable when from any cause such as severe bronchitis or pneumonia, the respirations are feeble and shallow; it is then best give subcutaneously in frequently repeated doses.

Nervous system.—It has been given for a numbe of nervous diseases, but with no certain good results for when the disease is not in the anterior cornua strychnine is hardly indicated; and if it is in thi part of the cord, it is doubtful whether it is advisable to stimulate the part of the body which is diseased.

Toxicology.

In about an hour after a poisonous dose the patient begins to feel uneasy from a sensation of impending suffocation. Tetanic convulsions then commence with great violence, nearly all the muscles of the body being affected at once. The limbs are thrown out, the hands are clenched, the head is jerked forwards and then bent backwards, and the whole body is perfectly stiff from the violence of the contractions. The pulse is very rapid; the temperature may rise. Hearing and sight are acute. The convulsion lasts a minute or two, then the muscles relax, and the patient feels exhausted and sweats all over. The intermission is short, convulsions soon come on again, and again there is a relapse to the state of muscular relaxation. The convulsions now rapidly increase in severity, and owing to the violent contractions of the muscles of the back, the patient is in the position of opisthotonos, resting on his head and his heels. The abdominal muscles are as hard as a board, the chest is fixed, the face becomes livid, the eyeballs protruding. The contraction of the muscles of the face causes risus sardonicus; but those of the jaw are not affected till quite the end. Consciousness is retained to the last. The slightest noise or even a bright light will reflexly bring on the convulsions, which may jerk the patient out of bed. Ultimately he dies from exhaustion and asphyxia. The smallest dose of strychnine known to have killed is half a grain. *Post mortem.* The usual appearances of death by asphyxia are seen.

Strychnine poisoning is liable to be confounded with *tetanus*, but in this disease symptoms come on more slowly, the muscles of the jaw are implicated very early, and there is continuous muscular rigidity with paroxysmal exacerbations, but never complete muscular relaxation.

Treatment. Put the patient at once under chloroform or ether. Wash out the stomach with potassium permanganate as for opium (*see* p. 376). Apomorphine should be given hypodermically if the jaw is locked. Inject large doses of potassium bromide and chloral hydrate *per rectum*. Use amyl nitrite inhalations, and if possible artificial respiration.

Antagonism.

In a sense strychnine is antidotal to chloral and morphine, but it is not a strict antidote, for they act chiefly on the cerebrum. Still, chloral is valuable in strychnine poisoning, and

although the antagonism with Calabar bean and gelsemiun more accurate, as both depress the anterior cornua, yet th **are of very little use in strychnine poisoning.**

PHYSOSTIGMINE SULPHATE.

Physostigminæ Sulphas. $(C_{15}H_{21}N_3O_2)_2,H_2S$
Synonym.—Eserine sulphate.

SOURCE.—The sulphate of an alkaloid obtained fro Calabar bean, the seeds of *Physostigma venenosum.*

CHARACTERS.—Minute white crystals, becoming yell on exposure to light and air. Bitter taste. Very solu in water and alcohol. The solution in salicylic acid permanent.

Dose. $\frac{1}{64}$ **to** $\frac{1}{32}$ **gr. 1 to 2 milligrms.** **Best giv subcutaneously.**

Preparation.

Lamella Physostigminæ.—Physostigmine su phate, $\frac{1}{1000}$ gr. (0·065 milligrm.); gelatin and glycer together, $\frac{1}{50}$ gr. (1·3 milligrms.) in each lamella.

ACTION.

External.—None.

Internal.—*Mouth.*—After physostigmine is ab sorbed it **increases the salivary secretion**; and thi has been shown to be due to stimulation of the ter minations of the secretory nerves in the glands Other secretions are increased, probably in the sam way. After a time the flow of saliva ceases, becaus the drug has so acted on the circulation as to constric the vessels, and consequently the flow of bloo through the salivary glands is diminished.

Stomach and Intestines.—The **muscular coat** o the stomach and intestines is greatly **stimulated** by the direct action of the drug circulating through it The result is that after a large dose vomiting and purging occur. Physostigmine is quickly absorbed.

Circulation.—No influence on the blood is known. The effect on the heart is obscure, but it appears that the irritability of the peripheral terminations of the vagus is at first increased, and that consequently the heart is **slowed**. Very large doses are said to decrease the irritability of the vagus. In addition to its effects on the vagus, physostigmine, in frogs at first, powerfully stimulates the contractile force of the heart. The **beat** is therefore both more **forcible** and slower. Ultimately the organ is paralysed and stops in diastole.

The **blood-pressure rises** very much: this is partly due to the increased force of the cardiac beat, partly to stimulation of the vaso-motor centre, partly by contraction of all the unstriped muscle of the abdominal viscera, driving much blood out of the abdomen. It is not known for certain if the unstriped muscle of the **arteries** is stimulated. Analogy would lead us to suppose that it is.

Respiration is first quickened but soon retarded, and **death** takes place from **asphyxia**. Three factors at least are probably concerned in bringing about these results. The ends of the vagi in the lungs are stimulated, for if these nerves are cut and physostigmine is administered there is no primary quickening of respiration. Physostigmine, from its action on involuntary muscular fibre, causes contraction of that in the bronchial tubes, with consequent constriction of them. Lastly and most important, the activity of the respiratory centres in the medulla and cord is depressed.

Nervous system.—Brain. Even in fatal doses consciousness is unimpaired. The only part of the brain certainly known to be affected is the respiratory centre, but it has been said that the motor cortex is temporarily excited.

Spinal cord. It is here that physostigmine produces its most characteristic effects. **Reflex activity** is **inhibited**; by exclusion it can be shown that this is not owing to any influence on the nerves or voluntary muscles, therefore it is due to **depression of the**

spinal cord. The most conclusive proof of thi
the direct application of the drug to the cord. Th
is, then, at first, from the irritation, which is cau
by almost any substance, a slight increase of re
excitability, but this soon gives way to compl
abolition of it. Later on, the posterior part of
cord is also paralysed, so that there is a diminut
of cutaneous sensibility.

Voluntary muscles and their nerves.—Muscu
twitchings follow large doses in many anima
These appear to be due to action on the motor ne
terminations; sensory nerves are unaffected.

Involuntary muscles. We have already seen th
the involuntary muscles of the intestines, stoma
and bronchial tubes are made to contract by physost
mine; so also are those of the spleen, uterus, bladd
and iris. Probably in all these instances it is t
terminations of the motor nerves that are affected.

Eye. Physostigmine applied locally to the co
junctiva or introduced into the circulation causes **co
traction of the pupil, spasm of accommodation** fro
direct stimulation of the ends of the motor nerves
the iris and the ciliary muscle. There is a **dimin
tion of intra-ocular tension.** Thus, as regards bo
secretions and the eye, physostigmine is antagonist
to atropine.

The action of physostigmine is much more co
stant than that of Calabar bean, perhaps because th
other active principles in the bean interfere with th
action of physostigmine.

THERAPEUTICS.

Involuntary muscles.—Because it stimulates un
striped muscle physostigmine has been recommende
for chronic constipation, atony of the bladder, an
chronic bronchitis with deficient power of expectora
tion, and although rarely given for these purposes

subcutaneously, it is useful to unlock the bowels after abdominal operations.

Spinal cord.—Physos'igmine has been used for tetanus, and some cases of recovery have been reported. It must be administered boldly. The extract has often been given, but it is better to inject physostigmine sulphate under the skin. Doses of gr. (2 milligrms.) frequently repeated may be employed, but the patient must be carefully watched. Physostigmine has been given as an antidote for strychnine poisoning.

Eye. The lamellæ are placed in the eye to break up adhesions of the iris, to diminish intra-ocular tension, and to prevent prolapse of the iris after wounds or ulcers of the cornea. It is also employed in glaucoma, in paralysis of the iris and ciliary muscles, and to prevent the entrance of light into the eye in photophobia. If used in solution, ½ to 2 gr. (3 to 12 centigrms.) of physostigmine sulphate to 1 fl. oz. (30 mils) of water is the usual strength.

ANTAGONISMS.

It will be observed that in its actions on the pupil, on secretion, on the heart, and on respiration, physostigmine is antagonistic to atropine. In its action on the spinal cord and respiratory centre it is antagonistic to strychnine.

GELSEMIUM.

Gelsemii Radix. Yellow Jasmine. The dried rhizome and root of *Gelsemium nitidum*. From the south-eastern United States.

CHARACTERS. Nearly cylindrical, about 15 centimetres long and 6 to 18 millimetres thick, occasionally small rootlets mixed with or attached to the larger pieces. Thin cortex, porous yellowish radiate wood, conspicuous straight medullary rays. Rhizome brown; dark violet cork. Root yellowish brown. Odour aromatic. Taste bitter.

COMPOSITION. The chief constituents are (1) Gelsemine, a very poisonous alkaloid, existing as yellowish-white minute crystals, soluble in alcohol and ether, but sparingly in water. The hydrochloride, which is freely soluble in water, is the common salt. (2) Gelsemmine, a yellowish-brown, substance, soluble in alcohol and ether, sparingly in wate

There is much confusion between these bodies, gelsemine is often called gelseminine and vice versa

Dose, of gelsemine hydrochloride, [illegible] **to $\frac{1}{20}$ gr. 1** **milligrms.**

Preparatum.

Tinctura Gelsemii.—Gelsemium, 1; alc (60 per cent.), 10. Percolate.

Dose, 5 to 15 m. 3 to 10 decimils.

ACTION.

External.—None.

Internal. Gelsemium produces no effect on stomach or intestines. Its powerful general phys logical effects are due to the gelsemine in it.

Brain. In poisoning by gelsemium consciou ness is maintained till the end; the drug, therefo has no power on the higher cerebral centres.

Spinal cord.—The most marked symptom pr duced by gelsemium is **paralysis of all the muscl** of the body; and by a series of experiments, li those used for strychnine, this can be shown to due to **depression of the activity of the cells of t anterior cornua** of the spinal cord. If a larger do is given the whole of the lower neurons is depress and hence the peripheral motor nerves and the endings are paralysed. This is said to be followe by a depression of the sensory part of the cord, wi consequent anaesthesia, but this is less important. Th result of the action of the drug is that the patie may be unable to walk, or if he can the gait staggering; his general sensibility is somewhat im paired. Convulsions may be produced. The caus of these cannot be made out, for they appear to b neither cerebral, spinal, nor peripheral.

Eye.—Gelsemium soon causes disturbance vision, then follows **diplopia**, due to **paralysis** of th **ocular muscles**, and from the same cause the upper lid drops. The **pupil is dilated.** All these symptoms ar bably owing to the paralysis of the neurons of the motor centres in the floor of the fourth ventricle and the aqueduct of Sylvius, for these are the continuation upwards of the anterior cornua.

Circulation.—The action of moderate doses is not marked. Toxic doses are powerfully depressant; the force and rate of the pulse and the blood-pressure fall. This is owing to a direct action on the cells of the vagal ganglia, the drug acting like nicotine.

Respiration. Soon after the administration of gelsemium the respiration becomes slower and more feeble; ultimately it stops, death taking place by asphyxia. This is due to paralysis of the respiratory centres in the cord and medulla. Before death the temperature falls, and the skin is bathed in a cold sweat.

THERAPEUTICS.

Gelsemium was formerly given for many conditions, but as it did no good and is an uncertain, very powerful poison, it is not often prescribed, but sometimes it is used successfully for neuralgia and migraine. A good combination for these diseases is gelsemine hydrochloride $\frac{1}{200}$ gr. (0·3 milligrm.), with chloral hydrate 3 gr. (2 decigrms.), made into a pill with mucilage, and given every two hours till the pain is relieved. Formerly, too, it was employed to dilate the pupil and paralyse accommodation. It will do this when applied locally, for it is quickly absorbed from the eye. Discs, each containing gr. (0·1 milligrm.) gelsemine, are made for application to the eye.

Class III. Vegetable Drugs acting chiefly on Nerves.

Conii Folia.—(Not official.)

Hemlock Leaves. *Synonym.* — Conium. The fresh leaves and young branches of *Conium maculatum*, the spotted hemlock, collected when the fruit begins to form (in June).

COMPOSITION. The chief constituents are—(1) C $C_8H_{16}HN$, propyl piperidine the active principle. A yell oily, strongly alkaline liquid alkaloid, with a mouse-like and a tobacco-like taste. *Solubility.* 1 in 100 of water. easily obtained from the plant by distillation with alka is most abundant in the fruit. It is readily decompos light and heat, and the preparations of conium are the of very varying strengths. Its salts are much more (2) Methyl-coniine, $C_8H_{16}CH_3N$. A colourless fluid all (3) Conhydrine, a nearly inert crystallizable alkaloid

ACTION.

External. Coniine probably has no influence the unbroken skin, but has been thought to anæsthetic when applied to painful broken faces. This is doubtful, for in the first place we no proof that it can be absorbed from sores; secondly, experiments show that large doses have be given to depress the activity of sensory nerves

Internal. —*Gastro-intestinal tract.* It may oc sionally give rise to vomiting and diarrhœa for it on all sympathetic ganglia like nicotine.

Circulation.—Coniine is absorbed into the bl and circulates unchanged. It causes vacuoles appear in the red cells. It depresses the cardiac va ganglia, and hence the pulse quickens; speak generally coniine, like nicotine, paralyses periphe ganglia; this is one cause of the fall of blood press The heart beats long after breathing has ceased.

Respiration. Owing to the profound paraly of all the motor nerves, and the later depression the respiratory centre and motor part of the co death takes place from enfeeblement of respirati and consequent **asphyxia.**

Nervous system.—*Nerves.* Coniine powerfu **depresses all the motor nerves.** This depressi begins at the periphery, and gradually **ascends** the whole nerve, up to the spinal cord, is incapab of responding to stimuli. This leads to paralysis in the muscles of the body as far as voluntary and reflex motion are concerned, but they themselves are unaffected, retaining their irritability to local stimuli. The sensory nerves are not implicated unless the dose is very large; then their conducting power is impaired. The effects on nerves are well illustrated by the death of Socrates, for he was directed to walk about till his legs felt heavy (motor paralysis), and later, when his foot was pressed he could not feel.

Spinal cord. This remains uninfluenced till quite late; then, if poisonous doses have been given, the function of its motor cornua is feebly depressed, as is also that of the respiratory centre in the medulla. These actions are probably due to the methylconiine. As the amount of this is variable in different specimens, the exact period at which these effects take on varies with different preparations. In some animals asphyxial convulsions are very marked.

Brain. Except for the respiratory centre, the whole of the brain is unaffected by coniine. Consciousness is preserved until the stage of asphyxia.

Eye. Coniine, when dropped into the eye, causes immediate contraction of the pupil reflexly from the conjunctival irritation. But soon the **pupil dilates**, and accommodation is paralysed; the same usually happens when the drug is given internally. Probably these results are owing to paralysis of the terminal portions of the third nerve, for well-marked ptosis, which is due to this cause, is present, but the pupillary effects are partly due to depression of the ciliary ganglion, as coniine paralyses all peripheral ganglia.

Coniine is excreted unchanged, chiefly in the urine.

THERAPEUTICS.

External. Conium has been applied to painful ulcers and sores, but it is, for the reasons already

given, doubtful whether it produces any good
It has also been employed for myalgia and
matism, but it is quite useless.

Internal. Conium is rarely given as a med
for (*a*) the amount of conine extracted by any
paration is very variable; (*b*) the amount in
same part of different plants is inconstant; (
amount of methylconine present is also very
certain; (*d*) conine is very volatile; (*e*) it is unst
light and air making it inert. For these reas
is probable that often the old pharmacopœial
parations contained no conine at all. Ounce
the succus (B. P. 1898), which was believed t
the most reliable preparation, have frequently
swallowed without producing any effects. Co
has been given in spasmodic diseases, as whoop
cough, in chorea, tetanus, asthma, and epilepsy,
in all it does little or no good.

Toxicology.

The symptoms produced by a poisonous dose are in s
accordance with the physiological action. The sufferer
his legs to be heavy; on attempting to walk he staggers,
finds he can hardly move them, and finally he [illegible]
because he has no power over them. The arms become po
less, and lie motionless at his side. There is ptosis, and dim
of vision from paralysis of accommodation; the eyes are fixed
pupil is dilated. Swallowing becomes difficult. Respirati
laboured, the voice is lost and death takes place from asphy
Post mortem. The organs are found congested with ven
blood.

Treatment. Emetics (p. 145), and wash out the stom
Give tannic acid and again wash it out. Stimulants subc
neously. Warmth to the feet. Artificial respiration.

Tabaci Folia. - (Not official.)

Tobacco Leaves. The dried leaves of *Nicotiana tabac*

Composition. The chief constituents are (1) Nicoti
$C_{10}H_{14}N_2$ (2-8 per cent.). A colourless, volatile, oily alkal
smelling and tasting like tobacco leaves, darkening with a

Soluble in water, more so in alcohol and ether. Turkish tobacco contains hardly any. (2) Nicotianin. (3) Salts and colouring agents.

Nicotine is the main and most active constituent of tobacco smoke. Pyridine bases are present, but not in sufficient quantity to produce any effect

ACTION.

Tobacco leaves act in virtue of their nicotine, one of the **most powerful and rapid poisons** known.

External. Nicotine is an antiseptic.

Internal.—*Gastro-intestinal tract.* Nicotine in even minute doses ($\frac{1}{7}$ gr., 10 milligrms.) promptly produces greatly increased salivary flow, due to action on the salivary ganglionic apparatus, burning pain in the mouth, œsophagus, and stomach, horrible nausea, quickly succeeded—owing to its action on the ganglia of the gastro-intestinal muscle—by vomiting and free purging accompanied by **extreme collapse.** Thus there are present a rapid, very feeble pulse, intense muscular weakness, laborious respiration, partial loss of consciousness, occasional convulsions, icy extremities, and profound general collapse. A dose of nicotine may kill in three minutes, but in both man and animals a certain tolerance may be acquired.

Circulation.—Nicotine disintegrates the red cells of freshly drawn blood, but has not this effect on living blood, although the **spectrum** of hæmoglobin is altered, so that the corpuscles must be in some way affected. Owing to slight stimulation with subsequent depression of the vagal ganglia and a similar effect on vaso-motor ganglia the pulse is at first slowed and the blood pressure raised, but soon the beat is powerfully depressed, the pulse becomes rapid, irregular, and feeble, and the blood-pressure rises and falls irregularly and rapidly; finally it falls profoundly.

Respiration.—This is at first accelerated and deepened; ultimately it is **paralysed** from depression of the centre. Death is partly due to asphyxia.

Nervous system. The higher faculties are depressed by large doses, for those poisoned become comatose within even a minute or two of taking a large dose. The convulsions occasionally observed in man, and always in the frog, are probably due to spinal stimulation. Ultimately the **function of the motor nerves is entirely abolished.** This explains the intense muscular weakness. Probably the sensory nerves, and certainly the muscles, escape.

Whether injected into the circulation or applied locally to nerve ganglia, nicotine paralyses them after a brief period of stimulation, and to this many of its actions, *e.g.* gastro-intestinal, are due. After internal administration or local application of nicotine the superior cervical ganglion, for example, is paralysed, so that while post-ganglionic stimulation causes blanching of ear, dilatation of pupil and secretion of saliva, pre-ganglionic has no effect.

Eye. A toxic dose taken internally, or the local application of nicotine to the eye, **contracts** the **pupil** of man and most animals. This will occur in excised eyes, and is therefore a local effect. With some animals nicotine is a mydriatic.

Secretion. Nicotine first stimulates but ultimately paralyses the secretory structures of the salivary, sweat, lachrymal, and probably all other glands. It acts on the ganglionic apparatus.

Elimination. Nicotine is eliminated partly by the lungs, but chiefly in the urine, the secretion of which it increases.

THERAPEUTICS.

Tobacco is never used therapeutically. Formerly it was employed in the form of an enema of the leaves to relax muscular spasm, so as to facilitate the reduction of dislocations.

Tobacco-smoking, in those who are unaccustomed to it, produces, to a greater or less degree, the symptoms of gastro-intestinal irritation and collapse just mentioned. Even in those who are used to it the smoke may produce catarrh of the pharynx. Moderate smoking raises the blood-pressure by vaso-motor constriction and quickens the pulse and respiration, and after breakfast assists the daily action of the bowels. After excessive smoking the vaso-motor centre is depressed, the blood-pressure falls, and there is general collapse. With many people smoking has an obscure effect, especially among those who lead sedentary lives, in stimulating the brain and producing a peaceable, calm state of mind. Over-indulgence in it may lead to loss of appetite, irregularity of the heart, chronic laryngeal and pharyngeal catarrh, and retrobulbar neuritis of the optic nerve. The effect of this is that the sufferer complains that objects look misty, he has a central scotoma, sometimes complete, often only for red and green, and finally atrophy of his optic nerve. Prolonged high blood pressure leads to degeneration of the arteries, and therefore prolonged excessive tobacco-smoking leads, as has been shown by Lee, experimenting with rabbits, to fibrosis of the inner and to a less extent of the middle coat, destruction of elastic fibres and deposition of calcium salts.

The pituri plant contains an alkaloid, piturine, acting exactly like nicotine. The leaves of it are used in Australia instead of tobacco.

COCAINA.

Cocaine. - $C_{17}H_{21}NO_4$.

Source. An alkaloid obtained from Coca (Erythroxylum Coca) leaves and its varieties.

Characters. Colourless monoclinic prisms with a slightly bitter taste followed by numbness. *Solubility.*—Almost insoluble in water. 1 in 10 alcohol (90 per cent.); 1 in 4 ether; 2 in 1 chloroform; 1 in 4 oleic acid; 1 in 12 olive oil.

Preparation.

Unguentum Cocainæ. Cocaine, 1; oleic acid, 4; prepared lard, 20. *Strength.*—Contains 4 per cent of cocaine.

In India prepared suet instead of prepared lard should be used.

Cocainæ Hydrochloridum. Cocaine Hydrochloride. $C_{17}H_{21}NO_4.HCl$.

The hydrochloride of the alkaloid cocaine.

CHARACTERS. Colourless acicular crystals or a crystalline powder. *Solubility.* 2 in 1 of water, 1 in 3 of alcohol (90 per cent.), 1 in 3 of glycerin. The solution has a bitter taste. it produces in the mouth a slight tingling followed by prolonged numbness. It is said to keep better if $\frac{1}{2}$ per cent. solution of boric acid be added to it.

Dose, $\frac{1}{10}$ to $\frac{1}{4}$ gr. 6 to 16 milligrms.

Preparations.

1. **Injectio Cocainæ Hypodermica.** Cocaine hydrochloride, 5; salicylic acid (to preserve the solution), 0·15; water, 100. *Strength.*—5 per cent.

NOTE.—This was 10 per cent., B. P. 1898.

Dose, 5 to 10 m.—3 to 6 decimils subcutaneously.

2. **Lamella Cocainæ.**—Discs of gelatin and glycerin each weighing $\frac{1}{20}$ gr. (3·5 milligrms.), and containing cocaine hydrochloride $\frac{1}{50}$ gr. (1·3 milligrms.)

3. **Trochiscus Krameriæ et Cocainæ.**—Each contains extract of krameria 1 gr. (0·06 grm.), cocaine hydrochloride $\frac{1}{20}$ gr. (0·003 grm.), with a fruit basis.

ACTION.

External.—Cocaine has little action on the unbroken skin, but if injected subcutaneously or applied to mucous membranes—as, for example, those of the eye, nose, mouth, rectum, vagina—it produces complete **local anæsthesia** to pain and touch, so that small operations can be performed without the patient feeling them. A 5 or 10 per cent. solution of the hydrochloride is strong enough to thus paralyse the sensory nerves. Stronger solutions must be applied to abolish sensations of heat and cold and to paralyse motor nerves. If a solution is injected into the subdural space of the spine, sensation—and with larger doses motion—is abolished in the parts the nerves of which arise from the cord below the point of injection; thus by injection between the 3rd and 4th lumbar vertebræ, sensation in the lower limbs and abdomen up to the umbilicus is abolished. When applied locally cocaine stimulates vaso-constrictor nerves and hence arteries contract.

Internal. *Gastro-intestinal tract.*—Applied to the nose or tongue cocaine abolishes smell and taste (especially for bitter substances) respectively, and when it is taken internally, the gastric mucous membrane experiences its anæsthetic influence. Therefore the sensation of hunger is deadened, and persons taking cocaine can go a long while without feeling the want of food; but the drug is not a food, for the body rapidly wastes. Digestion is not impaired. Because of its local anæsthetic effect it sometimes stops vomiting. Very large doses may lead to diarrhœa. In the organism it is quickly converted into ecgonine.

Circulation.—Large doses stimulate both the accelerator centre and the cardiac muscle, and therefore the pulse quickens, and as both the vaso-motor centre and the sympathetic nerve terminations in the arterioles are stimulated the blood-pressure rises.

Respiration.—It acts upon the respiratory centre, first stimulating it, so that the rapidity and depth of respiration are increased; but soon depression of the centre follows, the respiratory movements become feeble, of the Cheyne-Stokes type, and death takes place from **asphyxia.**

Nervous system. – *Cerebrum.* — Cocaine is a *stimulant* to the central nervous system, affecting first the higher centres, later the cord. Subsequent to stimulation depression follows. Moderate doses greatly **increase the bodily and mental power,** and give a sense of calm and happiness with abolition of bodily and mental fatigue. This greater physical energy renders possible the performance of long, exhausting muscular feats. For these effects, coca leaves mixed with clay or ashes are chewed by thousands of the inhabitants of Peru and the neighbouring countries. A single large dose causes mental excitement, delirium, convulsions, and ataxy, with subsequent headache and depression. The ataxy is due to impairment of conduction of sensory impressions from the peripheral sensory nerves, but this is not enough to prevent increased reflex action. An excessive indulgence in the habit of coca chewing leads to indigestion, extreme emaciation, insomnia and enfeeblement of intellect.

Eye.—When a solution of cocaine of about 4 per cent. is dropped into the eye local anæsthesia is produced first of the conjunctiva and cornea, later of the iris. It is attained in about seven minutes, and lasts about seven minutes. At first there may be a transitory contraction of the pupil. This is probably due to reflex action, and soon it gives way to **wide dilatation.** The maximum is attained in an hour or two. The normal state is regained in from twelve to twenty-four hours. The dilated pupil is feebly responsive to light, and the dilatation is rapidly overcome by physostigmine. The ocular tension is slightly lowered, and the palpebral aperture is widened. Accommodation is partially, but never completely, paralysed. The vessels of the eye are constricted. These effects are chiefly **due to irritation of the sympathetic,** and as they are quickly produced by dropping the drug in the eye they are probably local. All these effects are slowly produced if large doses of cocaine are taken internally.

Muscles.—The amount of muscular work of which the body is capable is increased by cocaine, by its action on the central nervous system. The excretion of urea and nitrogenous metabolism are unaltered.

Temperature. This may rise in cocaine poisoning.

Kidneys. Cocaine is partly excreted by these organs. In dogs the drug is mainly destroyed in the tissues, only about 5 per cent. appearing in the urine. It diminishes sexual excitability.

THERAPEUTICS.

External.—A few drops of a 5 to 10 per cent. solution of the hydrochloride may be injected subcutaneously as a local anæsthetic when a very small operation has to be performed. Employed for larger operations by infiltration (*see* Benzamine Lactate p. 432), 0·01 to 0·1 per cent. solutions may be used. Solutions painted or dropped on may be used for operations on the mouth, throat, teeth (4 per cent.), eye (1 to 4 per cent.), ear, vagina, urethra, and rectum (4 to 10 per cent.), and they may be applied to any of these parts when they are very painful. Cocaine will relieve vulval pruritus, and has been used locally to the nose in hay fever. Painful ulcers and fissures are beneficially treated with it. Ointments, bougies, and suppositories, usually containing 2 to 5 per cent. of cocaine, which is soluble in fats while the hydrochloride is not, are very useful. A 15 per cent. solution has been injected into the gums for tooth extraction, but is not strongly recommended. Cocaine lanolin (8·5 per cent.) is applied to painful dental cavities. Oculists employ cocaine very largely to produce local anæsthesia of the eye.

Internal.—*Mouth.*—A solution is useful for painting or spraying on to the throat previous to laryngeal examinations. The lozenges of Krameria and Cocaine are valuable for painful sore throats.

Stomach. Cocaine in some cases allays excessive vomiting, and has been said to cure sea-sickness.

It is not often used in Europe as a medicine for its restorative effects · as already mentioned, it is not a food, and the good it does is only temporary. It is a respiratory depressant ; but severe poisoning symptoms are rarely noticed unless the drug is injected. Then it may quickly cause vertigo, pallor, fainting, profound cardiac and respiratory depression with tremors and other nervous symptoms which may in very rare instances persist for months, even if the other symptoms are overcome.

Chronic Cocaine Poisoning. Synonym, Cocamania. The sufferer takes cocaine either for its pleasant effects or because he thinks it will help him to break himself of the morphine habit, or he takes it with morphine. It is usually administered subcutaneously. The pulse is rapid, and fainting is common. There is much wasting and the patient looks pale and death-like. Usually he suffers from insomnia and he may become acutely maniacal with delusions of persecution. Visual and other hallucinations are often present, and it is very characteristic that patients complain of little animals creeping on the skin, "cocaine bugs," they say. As a result of the cerebral stimulation, they are extraordinarily prolix in both conversation and writing.

BENZAMINÆ LACTAS.

Benzamine Lactate. - $C_{15}H_{21}NO_2.C_3H_6O_3$, the lactate of benzoyl-vinyl-diaceton-alkamine.

Synonym. Betacaine lactate. Betacaine is also known as eucaine and β eucaine.

SOURCE. - Obtained by neutralizing benzoyl-vinyl-diaceton-alkamine with lactic acid.

CHARACTERS.—A white crystalline powder. Taste slightly bitter followed by a sensation of numbness. Soluble in 5 parts of water and 8 of alcohol.

Dose, $\frac{1}{8}$ to $\frac{1}{2}$ gr.—8 to 30 milligrms.

ACTION AND THERAPEUTICS.

Two artificial alkaloids allied to cocaine, viz. alphacaine ($C_{19}H_{27}NO_4$) and betacaine ($C_{15}H_{21}NO_2$), are used as local anæsthetics. The beta compound is the better, being less irritating, and when eucaine is spoken of the beta compound is meant and is official under the name of benzamine lactate. The hydrochloride is often used, but the official lactate is much better as it is more soluble. The action of benzamine is slower than that of cocaine, and weight for weight two or three times less powerful; but the anæsthesia is more prolonged, the heart and blood-vessels are not affected, and the pupil is not dilated. A 2 per cent. solution is used for the eye, a 4 per cent. for dentistry, and a 5 to 10 per cent. for mucous membranes or subcutaneous injection. It is used for large operations by infiltrating it into the tissues in the following way. Powders containing benzamine lactate 3 gr. (2 decigrms.), sodium chloride 12 gr. (8 decigrms.) are prepared: each dissolved in 3½ fl. oz. (100 mils) of water gives a solution of 2 in 1000. This solution is injected in various places into the part about to be operated upon. The injection of 3 gr. (2 decigrms.) of benzamine hydrochloride or lactate for a single operation is considered safe. Adrenalin hydrochloride 1 in 1000 is often added to diminish bleeding.

Amylocaine Hydrochloride.—$C_{14}H_{21}NO_2,HCl$. (Not official.)

Synonym.—Stovaine.

Cocaine, eucaine, and stovaine, when injected inside the spinal dura mater by puncture between the vertebral laminæ, produce sufficient local anæsthesia in all the parts having nerve supply from nerves leaving the vertebral canal below the site of injection, for the performance of operations upon them. The injection is usually made in the lumbar region, and more rarely between the first and second dorsal vertebræ. This mode of producing anæsthesia is no safer than general anæsthesia, but if it is employed stovaine is the best of the three, for it is more powerful and only has half the toxicity of cocaine. A sterile aqueous solution containing $\frac{1}{5}$ to 1 gr. (12 to 60 milligrms.) of stovaine may be used, and it is advised that $\frac{1}{150}$ to $\frac{1}{100}$ gr. (0·4 to 0·6 milligrm.) of strychnine be added to it.

Ethocaine.—(Not official.)

Synonym. Novocaine.

This substance is used in the same way as benzamine, and some say it is the better drug as it is less irritating. It is often combined with adrenalin. It is soluble in water: the subcutaneous dose is $\frac{1}{5}$ to 1 gr. (12 to 60 milligrms.).

KAVA RHIZOME.

Kavæ Rhizoma. The peeled, dried, and divided root, of *Piper methysticum.*

CHARACTERS. Light grey irregular fragments, 1 to 5 centimetres thick.

Officially used in Australasian Colonies.

Preparation.

Extractum Kavæ Liquidum. Percolate the powdered rhizome with a mixture of alcohol (90 per cent.) and alcohol (45 per cent.).

Dose, $\frac{1}{2}$ to 1 fl. dr.—2 to 4 mils.

ACTION AND THERAPEUTICS.

Hypodermic injection of the fluid extract produces anæsthesia at the point of injection, followed by general paralysis due to direct action on the cord, and thus illustrates the two main actions of the drug—viz. depression of the motor function of the cord and of the peripheral ends of sensory nerves. The production of local anæsthesia is due to a resinous constituent called 'Kawine,' which when placed upon the tongue or skin causes burning pain followed by local anæsthesia, and this burning pain is so great as to forbid the use of the drug as a local anæsthetic. The fluid extract is given quite empirically, but, it is said, successfully, in gonorrhœa, vaginitis, and leucorrhœa, and also as a diuretic.

'Kava,' or 'Ava,' is the name given to an intoxicating liquid made from the root of *Piper methysticum* in the Sandwich Isles. The intoxication produced differs from that of alcohol in that it is silent and drowsy; there are incoherent dreams and great loss of muscular power.

PILOCARPINE NITRITE.

Pilocarpinæ Nitras. Pilocarpine Nitrate. $C_{11}H_{16}N_2O_2,HNO_3$.

SOURCE.—The nitrate of an alkaloid obtained from the leaves of *Pilocarpus microphyllus* and other species of *Pilocarpus*. Jaborandi leaves.

CHARACTERS. A white crystalline powder. Commercial samples frequently contain isopilocarpine and pilocarpidine. *Solubility.* 1 in 8 of water, 1 in 50 of cold, freely in hot alcohol (90 per cent.)

Dose, $\frac{1}{20}$ to $\frac{1}{5}$ gr. 3 to 12 milligrms.—hypodermically.

ACTION.

External.—None.

Internal.—*Gastro-intestinal tract.*—Pilocarpine is very quickly absorbed, and soon produces **a great increase in the amount of salivary secretion.** The mouth seems warm, and there may be a feeling of tenseness about the salivary glands. The saliva contains an abundance of salts and ptyalin, and can convert starch into sugar. Its increase is due to a direct stimulation of the terminal filaments of the chorda tympani and other nerves which end in the cells of the salivary glands, so that stimulation of these nerves can add very little to the flow produced by the drug—in fact, not more than can be accounted for by vascular alterations. This action is antagonized immediately by atropine, as that paralyses the endings of these nerves. To a slight extent pilocarpine excites the secretion of the gastric juice, intestinal fluid, and pancreatic secretion. The unstriped muscle of the stomach and intestine is stimulated, and thus the drug may purge. The bile is unaffected. Large doses, especially of jaborandi, may produce vomiting.

Circulation. Pilocarpine has no effect on the blood, but it is a **cardiac depressant.** The pulse-rate, it is true, may be, and in the human being always is, a little accelerated at first, but soon it falls. This slowing of the pulse is at once set aside by atropine, but is not prevented by section of the vagus, therefore pilocarpine acts on the heart itself, stimulating the terminations of the vagus. The arterioles of the limbs and body generally are constricted by action on the nerve ends in the vessel walls, but the pulmonary arterioles are dilated. The vascular constriction and primary cardiac acceleration cause at first a rise of blood pressure, but soon the depression of the heart leads to a fall. The lymphocytes in the blood are increased.

Respiration. The amount of bronchial secretion is increased, and the bronchioles are constricted from excitation of the vagal endings in the bronchial muscles.

Skin.—Jaborandi, through its alkaloid pilocarpine, produces a very **profuse** secretion **of sweat.** It is the most powerful diaphoretic drug we have. A single dose may cause the flow of fifteen fluid ounces of sweat. It is said that the proportion of urea and chlorides in the sweat is greatly increased. This profuse diaphoresis is due to the action of the pilocarpine on the terminations of the nerves in the sweat-glands, and is stopped by atropine. The skin may flush, but this is not the cause of the diaphoresis. Under a course of jaborandi the hair grows more actively, but it becomes very coarse and dark.

Kidneys.—If the sweating is profuse the secretion of urine is lessened. Pilocarpine is excreted unchanged in the urine, which may contain sugar due to stimulation of the glycogenic function of the liver.

Temperature.—The temperature falls considerably. This is probably due in large part to the evaporation of the perspiration.

Eye.—Whether applied locally to the eye or given internally, pilocarpine produces **great contraction of the pupil**, due to stimulation of the ends of the third nerve in the eye, and this is antagonized by atropine. It also causes increased tension of the eyeball, and an approximation of the nearest and farthest points of distinct vision, due to contraction of the ciliary muscle.

Other actions.—It stimulates the uterus, and has in very rare cases produced abortion. It increases the secretion of milk, of tears, of nasal mucus, and of cerumen. It causes the spleen and bladder to contract.

It will be noticed that it has two main actions: (1) It stimulates the secretions, viz. those of the salivary glands, stomach, intestines, skin, pancreas, bronchial mucous membrane, nose, lachrymal glands, and ear. In those that have been investigated, and probably in all, it acts locally. It has not been decided in every case whether the cells of the glands or the nerve terminations in them are affected. (2) It stimulates the nerve terminations of involuntary muscles, viz. in the eye, the intestines, the stomach, the bronchial tubes, the uterus, the spleen, the heart, the bladder, and it acts on the muscular coat of the vessels. The most important effects are the diaphoresis, the salivation, and the myosis. It is consequently antagonistic in its action to atropine, but it is much weaker, for a small dose of atropine counteracts a very large dose of pilocarpine.

Children bear large doses of it well. Pilocarpine is much more used than jaborandi, as it is more prompt and more certain in its action, and is less likely to cause indigestion.

Isopilocarpine has in all respects a similar action to pilocarpine, but it is much less powerful; and so has pilocarpidine, but it is still less active.

THERAPEUTICS.

External.—Pilocarpine has been used locally to promote the growth of the hair. An ointment (Pilocarpine nitrate, 4 gr., 25 centigrms.; vaseline, ½ oz., 16 grms.; lanolin, ½ oz., 16 grms.), and a lotion (Pilocarpine nitrate, 2 gr., 12 centigrms.; quinine hydrochloride, 8 gr., 50 centigrms.; glycerin, 2 fl. dr., 8 mils; aqua rosæ, 6 fl. dr., 24 mils) have been used.

Internal. Pilocarpine has been employed for many conditions, but its great use is as a diaphoretic in Bright's disease. For this purpose ⅕ of a grain (12 milligrms.) or more of the nitrate is injected subcutaneously in the evening. The sweating is aided by wrapping the patient, who should be naked, in several warm blankets, giving him hot drinks, and putting a hot water bottle to his feet. After the sweating has ceased, he should be dried and left in a dry blanket. As it is such a powerful cardiac depressant, it must be given with great caution when the heart is diseased. Occasionally it is employed locally in affections of the eye. Patients suffering from deafness, due to disease of the auditory nerve or its terminations, are sometimes relieved by pilocarpine. Injected subcutaneously it has been given successfully as an antidote to belladonna poisoning.

Muscarine.—(Not official.)

Muscarine is an alkaloid extracted from a poisonous mushroom, *Agaricus muscarius.*

It acts exactly like pilocarpine, but is not used in medicine because it is such a very powerful poison.

Agaric Acid. *Synonym.* Agaricin. (Not official.)

A white micro-crystalline powder obtained from the white agaric, a fungus growing on the larch tree. It stops sweating by acting on the peripheral nerves of the sweat glands, but it does not inhibit any other secretions. It is given as a pill in doses of $\frac{1}{10}$ to 1 gr. (6 to 60 milligrms.) to stop the sweating of phthisis. The objection to its use is that it may cause vomiting and diarrhœa.

Curara.—(Not official.)

Synonyms.—Curare, Ourari, Urari, Wourara, Wourali. The South American arrow poison, prepared from the bark of *Strychnos toxifera* and other species of Strychnos.

CHARACTERS.—A blackish-brown, dry, bitter extract.

COMPOSITION.—It contains an extremely active poison, curarine or curarina, a yellowish-brown powder, intensely bitter.

Dose, $\frac{1}{20}$ to $\frac{1}{2}$ gr. 3 to 30 milligrms. subcutaneously.

Preparation. (B. P. C.)

Injectio Curaræ Hypodermica.—Curare, 10; sterilized water, 100.

Dose, 1 to 6 m.—6 to 36 centimils (subcutaneously).

Lamellæ or discs, each containing $\frac{1}{20}$ of a grain (3 milligrms.), are also prepared. They are dissolved in a few minims of water before injection subcutaneously.

ACTION AND THERAPEUTICS.

The physiological action of curare, by which it paralyses the end plates of the motor nerves of voluntary muscle, is well known. It has been given, and occasionally successfully, in tetanus.

GROUP II.

Vegetable Drugs whose Main Action is on the Heart.

Class I. The digitalis group, decreasing the frequency and increasing the force of the beat of the heart:

Digitalis. Strophanthus. Squill. Urginea. Convallaria. Erythrophlœum.

Class II. The aconite group, decreasing the frequency and decreasing the force of the beat of the heart:

Aconite. Veratrine.

Class I.—The Digitalis Group.

DIGITALIS.

Digitalis folia. Digitalis Leaves. *Synonym.* Foxglove Leaves. The dried leaves of *Digitalis purpurea*, the purple foxglove. Collected from plants commencing to flower, thoroughly dried at a low temperature and kept dry in well filled air tight containers. When powdered no portion should be rejected.

Characters. 12 to 30 centimetres long, up to 15 centimetres broad, with a winged petiole; ovate, subacute, crenate; somewhat rugose, hairy dull green above, densely pubescent and paler beneath. Odour faint. Taste very bitter, unpleasant.

Composition. The amount and character of the active constituents vary with the season, soil, and parts of the plant used. Preparations deteriorate with age, and the leaves of the cultivated plant contain only half the glucoside contents of the wild leaves. The chief constituents are (1) Digitoxin, a pentoside, the most active principle, very poisonous, cumulative. Insoluble in water, sparingly in ether, easily in chloroform and alcohol. Exists in commerce as minute white crystals. It is unsuitable for giving by the mouth or subcutaneously, as it is very irritant. (2) Digitalin; a crystalline glucoside possessing the actions of digitalis to half the extent of digitoxin. It is not a commercial product, and when ordered the substance called Digitalin verum Germanicum is usually supplied. This contains digitalin and digitoxin (se p. 441). (3) Digitonin, a saponin (*q.v.*); this is a cardiac depressant, but when given by the mouth it is not absorbed.

It is the principal [illegible] of the gastro-intestinal irritation produced by digitalis. [illegible] conduces to the solubility of digitoxin and digitalin in the infusion. The following glucosides have been described, but it is uncertain if they are distinct substances. (4) Digitophyllin, a glucoside. (5) Digitalein, an amorphous glucoside, soluble in water, and therefore suitable for hypodermic injections; dose hypodermically $\frac{1}{100}$ gr., said to be non-cumulative. (6) Digitin, a glucoside devoid of physiological action. All these glucosides are non-nitrogenous. (7) Two acids, digitalic and antirrhinic. (8) Other usual constituents of plants, as tannin, volatile oil, colouring matter, starch, sugar, gum, salts. It will be noticed that digitalis contains no alkaloids.

The following substances, all soluble in alcohol, are met with in commerce:

(A) Homolle's digitalin (same as Quévenne's digitalin), an amorphous yellowish-white powder or small scales, intensely bitter, inodorous, but irritating to the nostrils. Consists chiefly of digitalin with a little digitoxin. Possesses the action of the leaves. Granules of it are used on the Continent; each usually contains $\frac{1}{65}$ of a grain, which is equal to $1\frac{1}{2}$ gr. of the powdered leaves, but they are uncertain in composition.

(B) Nativelle's digitalin: light white crystalline tufts of needles, very bitter. Soluble in chloroform, not in water or ether. It consists very largely of digitoxin, and is cumulative. Dose, $\frac{1}{250}$ to $\frac{1}{65}$ gr. in a pill. This is a popular drug, and is usually given in granules containing $\frac{1}{4}$ milligramme in each.

(C) German digitalinum pulverisatum purum. Dose, $\frac{1}{4}$ to $\frac{1}{2}$ gr. by the mouth; $\frac{1}{60}$ to $\frac{1}{30}$ subcutaneously. A yellowish white powder. Soluble in water. Consists chiefly of digitalein, with some digitalin and digitonin. It is the most suitable preparation for subcutaneous injection.

(D) Digalen or "Digitoxin solubile," sold as an aqueous solution with glycerin added. Dose by the mouth, 15 ♏. It is mostly digitalein. It is very irritant when injected subcutaneously, and is for no purpose superior to the pharmacopœial preparations.

(E) Digipuratum. This is said to cause less irritation than any digitalis preparation, and is, therefore, often of use. It is sold as tablets, containing 0·1 grm. Three or four to be given daily.

(F) Digitalone, not much used.

INCOMPATIBLES. Per-salts of iron (*see* p. 450), lead acetate, cinchona.

Dose, $\frac{1}{2}$ to 2 gr. 3 to 12 centigrms. of the powdered leaves. Subcutaneous administration of digitalis is not recommended, as being irritant; but the most suitable preparation is Digitalinum Pulverisatum Purum Germanicum (*see* p. 440).

Preparations.

1. Infusum Digitalis. Digitalis leaves, 7; boiling water, 1000 (contains much digitonin, not much digitoxin). If kept long loses its physiological activity.

Dose, 2 to 4 fl. dr. 7 to 15 mils (note that it is drachms, not ounces).

2. Tinctura Digitalis. Digitalis leaves, 1; alcohol (70 per cent.), 10. Percolate. (Contains both digitalin and digitoxin.) Deteriorates with keeping.

Dose, 5 to 15 m. 3 to 10 decimils.

This is four-fifths the strength of the corresponding preparation, B. P. 1898.

As the proportion of the many constituents varies in the preparations, doses much larger than those just mentioned may often be given, and some prefer always to give the powdered leaves, but probably digitalis acts best when the recently prepared tincture is used.

ACTION.

External. The leaves are slightly irritating, but it is doubtful whether any of their constituents can be absorbed by the skin. Preparations of digitalis occasionally cause abscesses if injected subcutaneously.

Internal. *Gastro-intestinal tract.*—Digitalis is a **mild gastro-intestinal irritant**, and even moderate doses cause vomiting and diarrhœa in some people.

Blood.—It is somewhat slowly absorbed; it is not known to affect the blood.

Heart.—The first action of digitalis in mammals is to **slow the beat** of the heart, by **prolonging the diastole**. the duration of the systole is not altered, but its **force** is **greatly increased**, so much so that after large doses the heart may, in animals, be seen to become pale, because almost every drop of blood is squeezed out of it. The pulse is consequently increased in force, but retarded. If before the drug was given the heart was beating irregularly, it generally becomes **regular**. If the drug is taken internally, the whole of both ventricles is, in mammals, affected; but in frogs one portion of the ventricle may remain spasmodically contracted during the diastole of the rest of it. After toxic doses the contractions are very irregular, and finally the ventricles are in frogs arrested in systole, firmly contracted, quite pale, and unable to respond to any stimuli, but in mammals the heart finally stops in diastole. In frogs the slowing is due to a prolongation of systole, not diastole, for in them the direct action on the muscle is greater than that on the vagus mechanism; but the latter predominates in mammals, hence the lengthening of diastole. If locally applied to parts of the ventricle of the frog, only those parts to which the digitalis is applied are contracted; this is not so in mammals. The auricles are in most animals slowed by it, but the force of their beat is not much altered, because their muscular mechanism is much less developed than their vagal. In all animals large doses cause great irregularity of the auricular beat.

That these phenomena are partly due to the **direct action** of the drug on the **cardiac muscle** is shown by the fact that digitalis not only tonically contracts the frog's heart when applied locally, but it will even increase the force of the contraction when applied to the isolated apex in which it is believed no nerves exist, and it acts on the embryonic heart of the chick before the nerves are developed. But the **inhibitory activity** of the cardiac peripheral **end** of the **vagus is increased**; for a stimulation of the vagi, which, before the drug was given, had no effect, will, after the drug is given, stop the heart. Further, in warm-blooded animals, although digitalis does somewhat, it does not very greatly retard the pulse if the vagi have been cut, although it increases the force of the cardiac beat, therefore in them the **vagus centre** in the medulla must have been **stimulated** to a considerable extent. Cushny has shown that the vagal action, with most of the digitalis group of drugs, begins a little before the muscular.

It has been proved that small doses actually **increase the amount of work** done by the heart in a given time, thus there is a greater output at each ventricular contraction. This, indeed, must follow, for as the diastole is prolonged, the ventricular dilatation is excessive, so at the commencement of systole there is an abnormally large amount of blood in the ventricle, which, owing to increased ventricular force, is sent forward into the aorta. Large doses so slow the beat that the total work in a given time is lessened. Some of the benefit of digitalis is due to improved circulation through the coronary arteries.

Vessels. Moderate doses of digitalis produce in animals a **great rise in the blood-pressure.** This is partly due to the greater cardiac force, but not entirely, for in the web of the frog's foot and the rabbit's mesentery the arterioles have been observed to contract vigorously when digitalis has been given. As this still occurs in arterioles quite separated from the body, and through which an artificial circulation of blood containing digitalis is carried on, it is clear that the drug contracts the arterioles by **direct action on their muscular** coat. But as the contraction is greater in an intact animal than in one whose spinal cord is destroyed, or in whom the nerves going to the part experimented upon are divided, it is clear that digitalis also **stimulates** the medullary and spinal **vaso-motor** centres. In man the effect of digitalis on the blood-pressure is very slight. With toxic doses the irritation of the centres and of the muscular coat of the arterioles passes on to depression, and the blood-pressure falls.

Kidney. The effect of digitalis on the kidney is uncertain, but usually in healthy men it produces slight diuresis, and the same discrepancy in its action on the kidney exists in patients with heart disease, but generally in these cases it is a **diuretic**. It certainly increases the flow in many healthy animals. It probably acts through the circulation.

We have no certain knowledge of the effect of digitalis on the constitution of the urine.

Excretion.—Digitalis is excreted partly by the gut, partly by the kidneys. This takes place more slowly than its absorption, so that the drug is cumulative.

Temperature. Moderate doses have no influence on the temperature, but toxic doses cause it to fall even in health. The reason of this is unknown.

Respiration. This is unaffected unless large doses have been given, when digitalis stimulates the respiratory centre.

Nervous system and Muscles.—With medicinal doses the only effect on the nervous system beyond stimulation of the vagal and vaso-motor centres, is that in some cases vomiting is partly due to stimalation of the medulla, which may also account for the deep respiration seen with large doses. These may cause headache, giddiness, and disturbances of sight and hearing, and sometimes all objects have appeared blue. These changes are not due to alterations in the cerebral circulation, as was formerly thought. Digitalis directly paralyses muscles if given in toxic doses.

Uterus. This organ is said to be stimulated to contract by digitalis.

THERAPEUTICS.

External. Digitalis is not used externally.

Internal. It is one of the most valuable drugs we have. It is chiefly given in cases of cardiac disorder.

Mitral regurgitation. If in any case of this variety of heart disease the organ is beating feebly, irregularly, and rapidly, digitalis in moderate doses will probably strengthen, regulate, and slow the beat. It will cause the left ventricle to contract more forcibly, and to act synchronously in all its parts; hence the mitral flaps will be better approximated, the regurgitation will be less, and more blood will be sent on into the arterial circulation. The prolonged diastole will also be of great advantage, for it will allow more time for the blood to flow from the dilated auricle, and from the right side of the heart and venous system generally, into the left ventricle. In mitral regurgitation, as is well known, venous engorgement and œdema of the lungs, of the right side of the heart, of the liver, the kidneys, and subcutaneous tissues are very common. Digitalis, by improving the venous flow towards the heart, will ameliorate all these symptoms. It might be supposed that by constricting all the peripheral arterioles it would impede the arterial flow because the heart will have to contract against a greater peripheral resistance, but this disadvantage is never enough to seriously hamper the increased cardiac power; and it must be remembered that it is a great advantage to the circulation to have a proper peripheral arterial resistance, for without that the elastic coat of the arteries cannot aid the arterial flow. If, as it usually does in these cases, digitalis acts as a diuretic, this will be of great value in removing the œdema, and in causing the scanty high-coloured urine to become pale and abundant. The improvement in the circulation relieves the cardiac pain and distress which so commonly accompany mitral regurgitation, the lividity passes off, the dyspnœa decreases, and usually in a day or two a wonderful improvement in the patient's condition takes place. The more any case of mitral regurgitation deviates from the above water-logged type, the less good, as a rule, will digitalis do. Thus cases in which there is much pain and distress and but little regurgitation are not so often benefited, although even of such cases many are improved. Sometimes the vomiting caused by digitalis prohibits its use. Fatal syncope may occur in those taking digitalis if they are too suddenly raised from the prone to the upright posture.

Mitral constriction.—In this condition it is obvious that it will be a great advantage to lengthen the diastole, for then there will be a greater chance that the diastole will be long enough to allow the normal amount of blood to pass through the constricted orifice. In proportion as this end is attained, the œdema, lividity, and other signs of backward venous congestion will be relieved, and if the digitalis induces diuresis this is very valuable in aiding the reduction of the œdema.

Disease of the tricuspid valve. In both tricuspid constriction and tricuspid regurgitation digitalis will be beneficial in the same way as in similar affections of the mitral valve. As a rule, however, it does less good when the disease is on the right side of the heart.

Aortic regurgitation. Often digitalis is harmful for by prolonging the diastole more time is allowed for the blood to fall back through the imperfectly closed aortic orifice, and hence there is great danger of fatal syncope. The drug should only be given in cases of aortic regurgitation when the heart is rapid, or when there is evidence that not much blood regurgitates, or when there are reasons, such as the coincident presence of aortic obstruction, for wishing to strengthen and regulate the contraction, but then it may do much good. The dose must be small and the effects must be carefully watched.

Aortic obstruction. This, unfortunately, is usually accompanied by aortic regurgitation; but sometimes when it is wished to increase the force of the beat, and so to drive more blood through the constricted aortic orifice, digitalis is useful, or when as a result of the obstruction, mitral dilatation and consequent regurgitation, with much pulmonary and venous engorgement, have set in. Many cases of pure aortic obstruction do not require drugs, for the heart hypertrophies sufficiently to overcome the obstruction.

Bright's disease.—In cases of contracted granular kidney in which the cardiac hypertrophy has been unable to overcome the peripheral resistance, and consequently the left ventricle and with it the auriculo-ventricular orifice has dilated, and mitral regurgitation has therefore ensued, digitalis may be of service, for the reasons given on p. 442. A diuretic pill, often used for this condition, consists of mercurial pill, digitalis leaves, and squill, a grain of each, made up with extract of henbane. Otherwise in chronic Bright's disease digitalis is not a suitable diuretic, for it raises the tension of the pulse, which is already high. In the earlier stages of acute Bright's disease it has been given as a diuretic, but it is questionable whether it is right to constrict the vessels of an acutely inflamed organ; further, digitalis is always, unless the heart is diseased, an uncertain diuretic, and even in the early stages of acute Bright's disease the arterial tension is somewhat raised. In chronic tubal nephritis uncomplicated by cardiac disease it is worse than useless, for it has no effect on the renal cells, and it raises the blood-pressure. It is a common error to give too little digitalis, some cases of cardiac disease are not benefited by less than doses of 30 minims (2 mils) of the tincture, and sometimes no good follows until the drug has been given for some days.

Diseases of the cardiac muscle.—If the heart be fatty or otherwise degenerate, digitalis rarely does good, for it is harmful for the diseased heart to have to work against the increased arterial tension, and it is said that there is danger of rupture of some of the degenerate fatty fibres. The weakly acting heart that is met with during pericarditis, pneumonia, typhoid fever, scarlet fever, rheumatism, and other acute diseases, even if no valvular defects are present, is markedly strengthened by digitalis. For this purpose it may be combined with caffeine, or two drachms of the infusion may be given, with three minims of strong solution of ammonia, in a little water. Each contraction is made more efficient, and the prolonged diastole allows more time for the muscle to rest. It is clear that in the course of twenty-four hours this additional repose, although but little in each cycle, will amount to a considerable time. Many men who have practised rowing or other hard exercise to excess suffer from shortness of breath, and the apex of the heart is found to be a little outside the normal position, but there is no demonstrable valvular lesion. This condition, which also occurs in soldiers after a long campaign, is much benefited by digitalis. The dilatation of the right side of the heart that so frequently accompanies chronic disease of the lungs may be, but is not usually, improved by digitalis.

Functional disease of the heart.—The irregular palpitating beat, often seen apart from any organic disease, may be benefited by digitalis ; but it must be remembered that this condition is commonly a result of indigestion, in which case the right treatment is, if possible, to cure the dyspepsia, and if digitalis is given at all, to do so cautiously, for it may excite indigestion. The functional affections of the heart met with in highly neurotic subjects may be, but are not often, benefited by digitalis.

Exophthalmic goitre may improve under a long course of digitalis, but generally this treatment fails.

Hæmorrhage.—Although digitalis contracts the arterioles it is not often given as a hæmostatic, for the increased blood-pressure may lead to greater hæmorrhage, but it may be useful in the pulmonary hæmorrhage due to disease of the mitral valve.

Alcoholism. Moderate doses of digitalis have been said to be serviceable in chronic alcoholism on account of their stimulating effect on the circulation. Enormous doses have been given empirically in delirium tremens, but generally without any good result.

Uterus. Because of its power to contract the uterus digitalis may be useful in menorrhagia.

It is often desirable to combine fluid preparations of digitalis with salts of iron; the resulting mixture, which is usually inky from the action of the iron on the tannin in the digitalis, can be clarified by the addition of a little citric acid. Because of this difficulty the powdered digitalis leaves are often made into a pill with dried sulphate of iron.

ANTAGONISMS.

Antagonism between digitalis and aconite.—Aconite is a cardiac poison, weakening instead of strengthening the beat; it dilates the peripheral vessels, it lowers the blood-pressure, and after death the heart is always found in a condition of diastole. In all these points it is antagonistic to digitalis. The action of aconite is very rapid, that of digitalis very slow. Therefore these drugs are not practical antidotes to each other in poisoning.

Scoparin is also physiologically antagonistic to digitalis.

Digitalis is **cumulative**. Patients who have taken it for a long while sometimes suddenly show symptoms of poisoning without any increase in the dose. This is because, as the drug is not excreted by the kidneys as fast as it is absorbed, it accumulates in the body, chiefly in the cardiac muscle. Those taking it constantly should generally omit it one week in every four. The most important symptom of poisoning is slowing of the pulse, but the most common is vomiting, and this often prevents its administration, but is least likely, it is said, to occur when the preparation used is given uncombined with other drugs. The irregular appearance of vomiting is sometimes due to the varying strength of the preparations (see Physiological Standardization, p. 9).

STROPHANTHUS.

Strophanthi Semina.—The dried ripe seeds of *Strophanthus kombé* freed from awns. Equatorial West Africa.

CHARACTERS.—Oval-acuminate, greenish fawn, covered with appressed silky hairs, about 15 millimetres long, 4 millimetres broad, base blunt, apex tapering, sides flattened, one side has a ridge from centre to apex, dorsal surface convex. Kernel white and oily, consisting of a straight embryo with two thin cotyledons surrounded by their albumen. Odour characteristic. Taste very bitter.

COMPOSITION.—The chief constituents are—(1) *Strophanthin*, $C_{40}H_{66}O_{19}$. This is the active principle. It exists in all parts of the plant, but mostly in the seeds (8 to 10 per cent.). It is bitter and occurs as a transparent, white, crystalline or as a pale yellow amorphous glucoside (being split up by acids into glucose and strophanthidin). Insoluble in chloroform and ether, soluble in water. (2) Kombic acid. (3) Inein, an active principle.

Strophanthin is more suitable than digitalis derivatives for subcutaneous or intravenous use. Dose for either purpose $\frac{1}{60}$ to $\frac{1}{100}$ gr. of an aqueous solution.

Preparations.

1. Extractum Strophanthi. Dried powdered strophanthus seeds are percolated with ether, dried, percolated with alcohol, dried, and diluted with milk sugar.

Dose, $\frac{1}{4}$ to 1 gr.—16 to 60 milligrms.

2. Tinctura Strophanthi. Dried strophanthus seeds, 1; ether, q.s.; alcohol (70 per cent.), 10. Percolate.

Dose, 5 to 15 m.—12 to 30 centimils.

This is made with four times the proportion of strophanthus seeds ordered for the corresponding preparation of the B. P. 1898.

ACTION.

External.—None.

Internal.—*Gastro-intestinal tract.*—Like digitalis, strophanthus is liable to cause **vomiting and diarrhœa,** especially if the dose be large. In small doses its bitter action may come into play, and then it will aid digestion like any other bitter stomachic.

MICROCOPY RESOLUTION TEST CHART

APPLIED IMAGE Inc

Heart.—Strophanthus acts on the **heart of mammals exactly like digitalis**, for it strengthens the force without altering the duration of the systole, prolongs the diastole, consequently slows the rate of the beat, and makes an irregular heart regular. In fatal cases of poisoning by strophanthus the heart may be arrested in either diastole or systole. The details of its cardiac action are the same as those of digitalis.

Vessels. It does **not constrict the peripheral vessels**, or at any rate very slightly; therefore, the slow rise of blood-pressure is almost entirely due to the action of the drug on the heart. This is the most important difference between it and digitalis, which contracts the vessels powerfully, and consequently gives a greater rise of blood-pressure.

Kidneys. In animals it is a more certain diuretic than digitalis. This is probably mainly due to the rise of blood-pressure taking place without vasoconstriction.

Nervous system.—This is not affected. In toxic doses it is a direct poison to the voluntary muscles. Strophanthin is a powerful local anæsthetic when dropped on the conjunctivæ.

Respiration. No particular effect is produced.

The African Kombé arrow poison is made from strophanthus.

THERAPEUTICS.

Strophanthus is used in the same varieties of cardiac disease as digitalis: that is to say, when it is desirable to slow the heart, to increase its force, to make it regular, and to prolong the diastole. It is clear, therefore, that it will be chiefly valuable in cases of mitral disease. *A priori*, it might be thought that as strophanthus does not contract the peripheral vessels and so increase the cardiac resistance, consequently it would be the more useful drug; but experience has not confirmed this, and therefore, in the treatment of a case of heart disease, digitalis should be used first; but if the patient does not improve on this, then strophanthus may be tried. It will sometimes happen that strophanthus will not produce vomiting when digitalis does, but there are many individual differences. Digitalis should usually be given when a diuretic effect is desired; but often strophanthus, as it does not constrict the peripheral vessels, is preferable when it is wished to give one of these drugs to a patient suffering from chronic Bright's disease. Strophanthus is not cumulative. It has been recommended in exophthalmic goitre. Probably other seeds than strophanthus seeds are often sold as such, hence the efficacy of the preparations is variable.

Strophanthin is used subcutaneously or intravenously in urgent cases of cardiac failure.

SQUILL.

Scilla.—Squill. The bulb of *Urginea scilla*, divested of its dry, membranous, outer scales, cut into slices and dried. When powdered should be kept quite dry over quicklime. Mediterranean coast.

CHARACTERS.—The slices of the inner scales are curved, yellowish-white or pinkish, translucent strips, 1 to 2 in. long. Odour none. Taste very bitter. Easily pulverizable if dry, not if wet.

COMPOSITION.—The chief constituents are—(1) *Scillitoxin*, or scillin, a glucoside, the most active principle. (2) Scillipicrin, also active, and closely related to scillitoxin.

Dose, 1 to 3 gr.—6 to 20 centigrms.

Preparations.

1. **Acetum Scillæ.** Squill, 10; acetic acid, 10; distilled water, 32. Macerate.

Dose, 5 to 15 m.—3 to 10 decimils.

This is approximately twice the strength of Acetum Scillæ. B. P. 1898.

2. Oxymel Scillæ.—Vinegar of squill, 200; purified honey, 500.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

3. Syrupus Scillæ. Acetum Scillæ, 175; sugar, 650; water, to 1000.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

4. Pilula Ipecacuanhæ cum Scillâ.—Squill, 1; compound ipecacuanha powder, 3; ammoniacum, 1; syrup of glucose, q.s. *Strength of opium*, 5 per cent.

Dose, 4 to 8 gr. 25 to 50 centigrms.

5. Pilula Scillæ Composita. Squill, 25; ginger, 20; ammoniacum, 20; hard soap, 15; syrup of glucose, 20.

Dose, 4 to 8 gr. 25 to 50 centigrms.

6. Tinctura Scillæ. Squill, 2; alcohol (60 per cent.), 10. Macerate.

Dose, 5 to 15 m.—3 to 10 decimils.

ACTION.

Squill so closely **resembles digitalis** in its **action** that the account of that drug will apply to squill **with** the following additions. Many believe that squill is a **more powerful gastro-intestinal irritant**; and that vomiting and purging result from even moderate doses, but often this is not so. In the second place, some constituent of squill is excreted by the bronchial mucous membrane, and in passing through it irritates it. The vascularity and the amount of secretion are thereby increased. Squill is, therefore, an **expectorant**. Thirdly, squill in the course of its excretion through the kidneys stimulates them; it is, therefore, a **more energetic diuretic** than digitalis, and it may irritate the kidneys excessively.

THERAPEUTICS.

Because of its irritating properties squill is not given alone, but it is frequently combined with digitalis when that drug is administered for **heart disease** or as a diuretic. A very favourite diuretic pill is composed of powdered squill, powdered digitalis leaves and blue pill, 1 grain (6 centigrms.) of each, made up with some simple vehicle.

Squill is much used as an expectorant. Here also it is always prescribed in combination; it is too irritating to the bronchial mucous membrane for it to be advisable to give it in acute bronchitis; nor should it be chosen in phthisis, lest it should cause dyspepsia; but it is valuable in chronic bronchitis if the secretion is scanty.

Squill should not be given in acute Bright's disease, for it is too irritating to the kidneys.

INDIAN SQUILL.

Urginea. The younger bulbs of *Urginea indica* taken soon after the plant has flowered, divested of their dry, outer, membranous coats, cut into slices and dried. When powdered should be kept dry over quicklime.

CHARACTERS. Curved or sickle-shaped strips, separated or connected, several together, to a portion of the shortened axis. Yellowish white, no odour, taste bitter

Dose, 1 to 3 gr. 6 to 20 centigrms.

Preparations.

1. **Acetum Urgineæ.** Urginea, 10; acetic acid, 10; distilled water, 32. Macerate

Dose, 5 to 15 m.—3 to 10 decimils.

This preparation is twice the strength of the Acetum Urginea of the Indian and Colonial Addendum, 1900.

2. **Oxymel Urgineæ.**—Vinegar of Urginea, 200; purified honey, 500.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

3. **Pilula Ipecacuanhæ cum Urginea.**—Compound ipecacuanha powder, 3; urginea, 1; ammoniacum, 1; syrup of glucose, q.s. *Strength of opium*, 5 per cent.

Dose, 4 to 8 gr.—25 to 50 centigrms.

4. Pilula Urgineæ Composita.—Urginea, 25; ginger, 20; ammoniacum, 20; hard soap, 15; syrup of glucose, 20.

Dose, 4 to 8 gr.—25 to 50 centigrms.

5. Syrupus Urgineæ.—Vinegar of urginea, 175; refined sugar, 650; water to 1000.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

6. Tinctura Urgineæ. 2 in 10 of alcohol (60 per cent.). Macerate.

Dose, 5 to 15 m.—3 to 10 decimils.

ACTION AND THERAPEUTICS.

Urginea has precisely the same action and use as squill. It is used chiefly in India and the East.

Convallaria Majalis. (Not official.)

The lily of the valley. The entire plant is used.

CHARACTERS. Leaves 4 to 6 in. long, radical, oblong, tapering. Flower stem leafless, radical, shorter than the leaves. Flowers white, bell shaped, drooping, forming a loose raceme.

COMPOSITION.—The chief constituents are—(1) Convallamarin, a glucoside, the active principle. (2) Convallarin, a glucoside, said only to purge.

Preparation (B. P. C.).

Tinctura Convallariæ.—The flowers, 1; alcohol (60 per cent.), 8.

Dose, 5 to 20 m.—3 to 12 decimils.

ACTION AND THERAPEUTICS.

The action of Convallaria Majalis is precisely that of digitalis, and it may be given in exactly the same varieties of heart disease. It is sometimes successful when digitalis has failed. It is not so powerful as digitalis, but some find it less likely to produce sickness.

Erythrophlœum.—(Not official.)

Casca Bark. *Synonyms.*—Sassy bark; Ordeal bark. The bark of *Erythrophlœum guineense* Africa

Composition.—The active principle is erythrophlœine, an alkaloid.

Preparation (B. P. C.).

Tinctura Erythrophlœi. Sassy bark, 1; alcohol (90 per cent.), 10.
Dose, 5 to 10 m.—3 to 6 decimils.

Action and Therapeutics.

The action of erythrophlœum is much the same as that of digitalis, and it may be used for the same class of cases. It is, however, more likely to cause vomiting, and the action on the inhibitory vagal mechanism is much more marked than that on the cardiac muscle.

Apocynum.—(Not official.) *Synonym.*—Canadian Hemp. The rhizome of root of *Apocynum cannabinum.*

Composition. It contains a crystalline body, apocynin, which is inert, and an active principle, cynotoxin or apocynamarin.

The action of Apocynum is exactly that of the other members of the digitalis group, except that it is often a considerable gastro-intestinal irritant; it contracts the vessels more than digitalis but does not act on the kidney directly. It is usually given as a tincture (B. P. C.). **Dose 5 to 10 m.—3 to 6 decimils.**

Class II.—The Aconite Group.

ACONITE.

Aconiti Radix.—Aconite Root. The dried root of *Aconitum napellus.*

Characters.—Usually 4 to 10 centimetres long. Upper extremity is 1 to 2 centimetres in diameter; conical, shrivelled, shows scars of broken rootlets; dark brown externally, whitish internally. Has a central axis with rays. Cautiously chewed, produces after some minutes tingling and numbness. Yields not less than 0·4 per cent. of ether-soluble alkaloids. Resembles horseradish (*see* p. 547).

Composition.—The chief active principle is the alkaloid aconitine (*see* p. 458). Two other alkaloids are present, viz.

aconine and benzaconine. Some commercial specimens of aconitine consist chiefly of these, which are much less powerful.

Preparations.

1. Linimentum Aconiti.—Powdered root, 500; camphor, q.s.; alcohol (90 per cent.), q.s. *Strength.* 0·2 per cent. or 0·2 grm. in 100 millilitres.

2. Tinctura Aconiti.—Powdered root, 1; alcohol (70 per cent.), q.s. Percolate. *Strength.* This contains 0·04 grm. of ether-soluble alkaloids in 100 millilitres.

Dose, 2 to 5 m.—12 to 30 centimils.

It is twice as strong as the corresponding preparation, B. P. 1898.

Aconitina.—Aconitine. $C_{34}H_{47}NO_{11}$.

SOURCE.—An alkaloid obtained from aconite root.

CHARACTERS.—Colourless, hexagonal prisms of the rhombic system. Melting-point, 198° C. Produces tingling when placed on tongue. Its salts are crystalline. Its solutions acidulated with acetic acid give a red crystalline precipitate on addition of potassium permanganate. By partial hydrolysis aconitine forms benzaconine, and on further hydrolysis it forms aconine and benzoic acid. *Solubility.*—Readily in alcohol and chloroform, less so in ether; nearly insoluble in water.

Preparation.

Unguentum Aconitinæ.—Aconitine, 1; oleic acid, 8; prepared lard, 41.

In India prepared suet should be used instead of prepared lard.

ACTION.

The action of aconite, which has been restudied by Cash and Dunstan, is due chiefly to the aconitine in it, and therefore they may be considered together. (For Benzaconine and Aconine *see* p. 460.)

External. Applied to the skin, to a mucous membrane, or to a raw surface, aconitine, and therefore aconite, first stimulates and then paralyses the sensory nerves; it thus causes first **tingling**, then **numbness and local anæsthesia** for touch, pain, and temperature, which last some time. Unless the skin is sound a dangerous quantity may be absorbed. It is intensely irritant to the nostrils, causing, when it is inhaled, sneezing and much secretion with an icy cold sensation.

Internal. *Gastro-intestinal tract.*—Unless it is very dilute, numbness and tingling are produced in the mouth. There are no other gastro-intestinal symptoms provided the dose is not very large; if it is, there may be vomiting and purging.

Heart.—If small doses are given to animals, the rate of the beat is soon very decidedly **steadied and slowed**; shortly after this the **force and tension** become **less**, and these effects are mainly due to a stimulation of the vagus centre. But after larger doses the pulse quickens, misses beats, and becomes irregular. Many of the ventricular beats have no corresponding auricular contraction, although the two auricles always contract together and the two ventricles always contract together. As the irregularity and frequency of ventricular contractions increase, the blood-pressure rapidly undergoes great variations. It is not until quite the end of its action that aconite influences the heart muscle. The ventricles, always more affected than the auricles, pass into a condition of delirium. Even small doses lead to a **fall of blood-pressure**, but all the effects on blood-pressure are almost entirely secondary to the action on the heart or its nerves. The vaso-motor centre is only slightly affected.

Respiration.—The respiration, after a transitory quickening, is **steadied and slowed**, expiration and the pause after it are considerably prolonged. The movements become more slow and dyspnœal, the respiratory centre is powerfully depressed, but it is not easy to decide whether death is due to this or to cardiac failure.

Nervous system.—It appears clear that aconite, whether given internally or applied locally, **depresses** the activity of the peripheral **terminations** of the nerves; the **nerves of common sensation and temperature** are affected long before the motor. Any **pain** that may be present is **relieved.** Large doses in man cause clonic convulsions, chiefly respiratory. Later on the paralysis of the motor nerves gives rise to muscular weakness. It is doubtful whether the cord is influenced. The cerebrum is not. The pupil is dilated.

Temperature.—Aconite causes a febrile temperature to **fall.** This is in part due to its action on the circulation and respiration, but probably other causes are at work.

Skin.—Aconite is a mild **diaphoretic**; in this case also we do not understand how it acts. Occasionally it produces an erythematous rash.

Kidneys.—It is said to be a feeble diuretic, but its effect is very slight. Aconitine is excreted in the urine.

Benzaconine is bitter, and does not cause tingling or numbness of mucous surfaces; in large doses it slows the pulse beat very strikingly because the auricular beats are frequently not followed by ventricular contraction. Its action is probably chiefly on the heart muscle itself. It does not paralyse sensory nerves, but greatly interferes with motor nerves and causes a semi-comatose condition. The fall of temperature produced by it is very slight. It will be noticed that it is in almost all respects contrary in action to aconitine.

Aconine is bitter, but does not produce numbness. It is non-toxic as regards the heart, and opposes the cardiac incoordination and asequence caused by aconitine. It depresses motor nerves and respiration very strikingly, probably acting like curare.

It is worth noting that, whilst the introduction into aconitine of two additional acetyl groups (as in diacetyl-aconitine) gives rise to a derivative very similar in action to aconitine, the loss of the acetyl group, as in benzaconine, almost entirely abolishes all physiological resemblance to aconitine. On the other hand, the removal of the benzoyl radical from benzaconine (aconine remaining) produces much less alteration in action although it does diminish the toxicity of benzaconine. Indaconitine, Pseudaconitine, and Bikhaconitine are alkaloids derived from Indian aconite.

THERAPEUTICS.

External.—As aconite produces local anæsthesia, it is applied externally and often with great benefit in cases of neuralgia, especially facial neuralgia. Frequently it fails, and we cannot tell beforehand whether it will succeed. A small piece of the ointment may be rubbed in till numbness is produced, but as this is a very expensive preparation it is usually better to paint on the liniment with a camel's-hair brush. The pain of chronic rheumatism is sometimes relieved by aconite. Chloroformum Aconiti (a B. P. C. preparation) and Linimentum Aconiti Compositum, commonly called A.B.C. Liniment, because it contains equal parts of Aconite Belladonna, and Chloroform liniments, are excellent preparations for external use. Aconite should never be used externally unless the skin is quite sound. Collodium Anodynum (B. P. C.), often called Anodyne Colloid, is useful for relieving pain. It contains aconitine and veratrine dissolved in acetone collodion. Sciatica and neuralgia are benefited by it.

Internal.—It may be given internally for neuralgia, but it does not succeed nearly so well as when applied externally. It is not used internally so much as formerly, when it was administered in almost every febrile disease, with the object of decreasing the force and tension of the pulse. It was said to do this very effectually, but Price did not find that it reduced the rate of the pulse in some patients he examined; the reason why it is not so popular at the present time is that it is not now thought desirable to reduce the force and frequency of the heart in these diseases. Perhaps it is used too little, for many believe that the milder febrile diseases, such as tonsilitis, laryngitis, or a common cold, are distinctly benefited by aconite, especially if they occur in children. In addition to retarding the pulse it increases perspiration and lowers the temperature. As large doses diminish the force of the heart, it is usually given in doses of two or three minims of the tincture every hour or so till the pulse falls to nearly normal; for the same reason it is not advisable to use it for prolonged fevers, as typhoid, nor when the heart is diseased, except in the few cases in which there is sufficient compensative cardiac hypertrophy. In such cardiac cases it is sometimes useful to slow the pulse, even when there is no fever. It will occasionally relieve the pain of aneurysm. A common practice was to combine with it one or two drops of Vinum Antimoniale, as that has much the same action on the heart. Formerly it was much used in surgery if it was feared that inflammation might set in after injuries.

TOXICOLOGY.

The symptoms come on quickly; in a few minutes there is a severe burning, tingling sensation in the mouth, followed by numbness. Vomiting begins in an hour or so, and is very severe. There is an intense abdominal burning sensation. The skin is cold and clammy. Numbness and tingling with a sense of formication of the whole skin trouble the patient very much. The pupils are dilated, the eyes fixed and staring. The muscles become very feeble, hence he staggers. The pulse is small, weak, and irregular. There is difficulty of respiration. Death takes place from asphyxia, or in some cases from syncope. The patient is often conscious to the last. *Post mortem.*—The usual signs of death from asphyxia are seen.

Treatment.—Wash out the stomach promptly; give emetics (p. 145). Use artificial respiration early. Inject stimulants, as ether or brandy, subcutaneously. Atropine and the tincture of digitalis should be given by mouth or subcutaneously. Hot blankets and bottles.

Veratrine.—(Not official.)

Veratrine, an alkaloid or mixture of alkaloids obtained from cevadilla, the dried ripe seeds of *Schœnocaulon officinale*. It usually consists of veratrine and slight admixtures of two other alkaloids, cevadine and cevadilline.

SOURCE.—Prepared from cevadilla by precipitation with ammonia.

CHARACTERS.—A pale grey amorphous powder. Odour none, but very irritating to the nostrils. Taste very bitter and acrid. *Solubility.*—1 in 6 of ether, 1 in 3 of alcohol (90 per cent.); readily in dilute acids; very feebly in water.

Dose, $\frac{1}{60}$ to $\frac{1}{15}$ gr.—1 to 4 milligrms., in pill.

Pure veratrine, $C_{37}H_{53}NO_{11}$, crystallizes in rhombic prisms but the veratrine usually seen is very rarely pure.

ACTION.

External.—Veratrine if it is applied to the unbroken skin, and especially if it is rubbed in, produces tingling and **numbness**, followed by a sensation of coldness and **anæsthesia** to pain, touch, and temperature. Given subcutaneously, it causes violent pain and irritation.

Internal.—*Gastro-intestinal tract.*—Inhalation of the minutest portion causes great irritation of the mucous membrane of the nose, violent **sneezing**, and a free **discharge of mucus**, which may be bloody. A speck on the tongue gives rise to burning pain and profuse **salivation**. On arriving at the stomach and intestine it produces great **epigastric pain, vomiting, and diarrhœa**. These results also occur if it is given subcutaneously.

Blood.—Veratrine is quickly absorbed. It is not known to affect the living blood, but it kills the white corpuscles in drawn blood.

Heart.—It acts directly on the cardiac muscle as it does upon voluntary muscle: that is to say, the **contractions** of the heart become **fewer**, but each **lasts a very long while** until ultimately the heart stops in systole. It also acts on the **vagus** as on spinal nerves, the functional activity being **first exalted**, and this is partly the reason of the slowing of the heart; afterwards the vagus is depressed, but this does not cause a quickening of the pulse, because of the action of the veratrine on the cardiac muscle, but it may make the beat irregular. The blood-pressure at first rises from the increased force of the beat, but when the heart becomes very slow it falls. Possibly these effects are also in part owing to the action of the drug on the vaso-motor centres.

Respiration. Small doses quicken respiration, large ones retard it, producing long pauses, and finally **arresting** it. These results are probably due at first to stimulation, and afterwards to paralysis of the ends of the vagus in the lung, and to paralysis of the respiratory centres. The temperature is lowered.

Nervous system.—The brain is unaffected, and probably veratrine has no influence on the spinal cord. **Motor nerves** are **first excited** and then **paralysed** by large doses, and the **same is true of sensory nerves** and their endings in smaller doses, but here the primary stimulation is more marked, hence the transient pain produced by the local inunction of veratrine.

Muscles.—The effect of veratrine is peculiar and characteristic. In animals to which it has been given, or in excised muscles to which it is applied, it is found that the period during which a single **contraction** lasts is **enormously prolonged.** If a tracing of the contraction be taken it will be seen that the time of the ascent of the curve is unaltered, that the height is greatly increased and the descent is extraordinarily extended. This is a genuine lengthened contraction, which is neither rigor nor tetanus, but it almost exactly resembles the contraction of the muscles met with in Thomsen's disease. This effect of veratrine disappears if the muscle is cooled.

THERAPEUTICS.

External. Veratrine has been used as an inunction for neuralgia, and sometimes it succeeds admirably, generally in the same class of cases as are benefited by the local application of aconite.

Internal. It is rarely given internally, as it has such a powerful and peculiar action on the heart.

GROUP III.

Vegetable Drugs employed for their Action on the Respiratory Organs, and not falling among Volatile Oils (q.v.).

Senega, Ipecacuanha, Lobelia, Virginian Prune.

The first three are gastro-intestinal irritants. Senega and ipecacuanha are both excreted by the bronchial mucous membrane, which they irritate. Group II. is connected with this group by senega, which acts on the heart like squill, and squill like senega is excreted by the bronchial mucous membrane.

SENEGA.

Senegæ Radix. The dried root of *Polygala senega*. From North America.

CHARACTERS.— Slender roots 5 to 10 centimetres long, of which the upper end is an irregular knotty tuberosity with remains of small stems, tapering below into a tortuous wrinkled keeled root, $\frac{1}{8}$ to $\frac{1}{2}$ in. thick. Bark yellowish or brownish grey, transversely cracked. Fracture short and brittle. Odour of bark peculiar and rancid, its taste at first sweetish, but afterwards very sour, and causing a flow of saliva. Central column woody, tasteless, and inodorous. *Resembling senega root.*— Arnica, Valerian, Serpentary, and Green Hellebore, but none of these have a keel.

COMPOSITION.—The chief constituents are—(1) Senegin, a glucoside, is the active principle; is identical with Saponin, found in Saponaria (Quillaia bark, *q.v.*), and many other plants. Saponin is decomposed by hydrochloric acid into sugar and sapogenin. It exists as a white powder, which forms a soapy emulsion when mixed with water. (2) Polygalic acid.

IMPURITIES.—Other roots are mixed with it.

Preparations.

1. Infusum Senegæ. Senega root powdered, 1; boiling water, 20.

Dose, ½ to 1 fl. oz. 15 to 30 mils.

2. Tinctura Senegæ.—2 to 10 of alcohol (60 per cent.). Percolate.

Dose, ½ to 1 fl. dr. 2 to 4 mils.

ACTION.

External.—Saponin is a powerful irritant, and hence senega is an **irritant** to the skin.

Internal.—*Alimentary canal.*—Senega is an **irritant** here also, producing salivation, vomiting, and diarrhœa. Even small doses often cause indigestion. It is absorbed with difficulty.

Circulation.—If injected into the blood saponin circulates as such. It arrests the **heart** in diastole, and is a general protoplasmic poison. It is excreted by the skin, the bronchial mucous membrane, and the kidneys, but when given by the mouth its action is usually limited to the alimentary canal, as very little is absorbed.

Respiration.—When the powdered root is inhaled its saponin acts as a violent irritant to the nose, causing much **sneezing** and coughing, together with hyperæmia and increased secretion from the respiratory mucous membrane. If senega is taken by the mouth it irritates the stomach, and so by reflex action increases the bronchial secretion and the tendency to cough. Senega is therefore a **stimulating expectorant.**

Kidneys.—If absorbed it is a diuretic, because the excretion of saponin through the kidneys causes irritation of them.

THERAPEUTICS.

Senega is only used as a stimulating expectorant. It is evident that it may be useful in bronchitis, when the secretion is scanty, and when the power to cough is feeble. As when absorbed it is an irritant to the bronchial mucous membrane, it must not be given in acute bronchitis, and its action as a general irritant and protoplasmic poison often renders it undesirable.

IPECACUANHA.

Ipecacuanhæ Radix. The dried root of *Psychotria ipecacuanha.* Brazil.

CHARACTERS. Twisted pieces not more than 15 centimetres long or 6 millimetres thick. Cortical portion thick, dark red or brown, annulated, with a short, resinous waxy fracture. Central portion whitish, woody axis. Taste acrid, bitter. Odour slight, peculiar.

COMPOSITION. The chief constituents are (1) Emetine, $C_{30}H_{40}N_2O_4$, or methyl-cephaeline, an alkaloid, an amorphous white powder (turns yellow on keeping), soluble in alcohol, ether, and chloroform, not in caustic alkali. (2) Cephaeline, $C_{28}H_{38}N_2O_4$. Colourless (turns yellow on keeping), soluble in caustic alkali, less soluble in ether than emetine, but freely in alcohol and chloroform. (3) A third alkaloid, psychotrine, exists in minute quantities. (4) A mixture called ipecacuanhic or cephaelic acid. (5) A glucoside. (6) Tannin, volatile oil, starch, gum, &c.

Powdered ipecacuanha root, if used for official purposes other than the preparation of standardized preparations, must be adjusted by the addition of milk sugar till it contains 2 per cent. of alkaloids. The proportion of each varies in different specimens of the root, but as a rule there is twice as much emetine as cephaeline. Emetine hydrochloride and hydrobromide are in the market; a solution of either of 1 grain in 8 fl. oz. of sherry is about the same strength as Vinum Ipecacuanhæ.

IMPURITIES. Hemidesmus, which is cracked, not annulated. Almond powder, occasionally found mixed with powdered ipecacuanha root, gives odour of prussic acid when moistened.

Dose of powdered root, ¼ to 2 gr.—3 to 12 centigrms. (expectorant); (**15 to 30 gr**)—**1 to 2 grms.** (emetic).

Preparations.

1. Extractum Ipecacuanhæ Liquidum.—Powdered ipecacuanha percolated with alcohol (90 per cent.), q.s. *Standardized to contain 2·0 per cent. of the alkaloids of the root.*

Dose, ½ to 2 m.—3 to 12 centimils.

2. Vinum Ipecacuanhæ.—Liquid extract of ipecacuanha, 1; sherry, 19. *Strength.*—0·1 per cent. of total alkaloids.

Dose, 10 to 30 m.—6 to 18 decimils (expectorant); **4 to 6 fl. dr.—16 to 24 mils** (emetic).

3. Pulvis Ipecacuanhæ Compositus.—*Synonym.*—Dover's powder. Ipecacuanha, 1; opium, 1; sulphate of potassium, 8. *Strength.*—10 per cent. of opium.

Dose, 5 to 15 gr.—3 to 10 decigrms.

4. Pilula Ipecacuanhæ cum Scillâ.—Compound ipecacuanha powder, 3; squill, 1; ammoniacum, 1; syrup of glucose, q.s. *Strength.*—5 per cent. of opium.

Dose, 4 to 8 gr.—25 to 50 centigrms.

5. Pilula Ipecacuanhæ cum Urginea.—Compound ipecacuanha powder, 3; urginea, 1; ammoniacum, 1. *Strength.*—5 per cent. of opium.

Dose, 4 to 8 gr. 25 to 50 centigrms.

6. Trochiscus Ipecacuanhæ.—0·015 grm. or ¼ gr. of ipecacuanha in each; made with a simple basis.

7. Trochiscus Morphinæ et Ipecacuanhæ.—Ipecacuanha, $\frac{1}{12}$ gr.; morphine hydrochloride, $\frac{1}{36}$ gr. in each (*see* Morphine, p. 364); made with a tolu basis.

ACTION.

External.—Ipecacuanha powder is a powerful **irritant** to the skin, producing redness, vesication, and pustulation. It has some **antiseptic** powers, for it can destroy anthrax bacilli, but it has no effect on the spores. This property is not due to its emetine, but to some other constituent: on the other hand, a weak solution of emetine will destroy the dysenteric **amœba** in broth culture.

Internal.—*Alimentary canal.*—Here also the irritating action of ipecacuanha is seen. It increases the flow of saliva, dilates the gastric vessels, and stimulates the secretion of gastric juice. Therefore **small doses** are distinctly **stomachic**, and aid digestion. Large doses are, however, powerfully **emetic**. This is chiefly due to their irritant effect upon the stomach, but in a much less degree to the fact that emetine acts directly upon the vomiting centre in the medulla, as can be proved by observing that when the alkaloid is thrown directly into the circulation vomiting follows before there is time for it to have been excreted into the stomach. Ipecacuanha is therefore both a direct and an indirect emetic. It produces a certain amount of depression, but not more than the mere act of vomiting will explain. It does not usually cause nausea. The irritant effect is continued in the intestine, and hyperæmia, excessive secretion, and purging result. In dysentery there is a peculiar tolerance of ipecacuanha. Ipecacuanha is said to increase the amount of bile secreted, and if so is a direct **cholagogue**.

Circulation.—Large doses of emetine depress the heart powerfully, the blood tension falls, and the heart finally stops in diastole.

Respiration.—This is unaffected. Ipecacuanha powder when inhaled, or if enough ipecacuanha is taken internally for it to be excreted by the bronchial mucous membrane, causes hyperæmia of it, together with an increased secretion of bronchial mucus, and therefore, reflexly, coughing is stimulated. It is consequently an **expectorant**; and because it depresses the circulation a little it is called a depressant expectorant. Animals to which large doses of ipecacuanha or of emetine have been given show, after death, considerable hyperæmia of the bronchial mucous membrane, of the lungs, and of the stomach and intestines, and the same condition of the respiratory passages is seen if ipecacuanha powder has been inhaled. With therapeutic doses, however, any expectorant action is mainly due to reflex action from irritation of the stomach.

Skin.—Ipecacuanha is a mild **diaphoretic.**

THERAPEUTICS.

External.—Ipecacuanha is never at the present day employed for its external irritant effect. It has been used with success, as an antiseptic, in cases of anthrax. It is directed that the wound should be dressed with the powdered root, and that 5 grains (3 decigrms.) should be taken by the mouth every four hours.

Internal. — *Stomach.* — Occasionally in small doses, such as 4 or 5 minims (2 or 3 decimils) of the vinum or $\frac{1}{4}$ gr. (16 milligrms.) of the powdered root, it is employed as a stomachic, and these quantities may even stop vomiting when other drugs have failed. A usual prescription to arrest the vomiting of pregnancy is a minim of ipecacuanha wine in water every half hour. The compound powder has been praised in cases of gastric ulcer; probably any good effect it may have is due to its stimulating power. Ipecacuanha is a very common emetic. It should not be given when it is desired, as in cases of poisoning, to empty the stomach quickly, for some time elapses before it is absorbed and influences the medulla; nor should it be given to the very feeble, for it has no action that will counteract the depression of the vomiting. But it is an excellent emetic when it is wished, by the act of vomiting, to empty the air-passages, as in bronchitis, the early stages of diphtheria, tracheitis, and laryngitis, for not only the vomiting but the effect of the ipecacuanha on the respiratory tract and the slight subsequent depression will be beneficial. It is chiefly employed for this purpose in children, as they cannot cough well, and often it seems to act like a charm. It used to be given in the early stage of fevers, to empty the stomach of undigested food. A good emetic powder consists of, for an adult, 20 grains (12 decigrms.) of powdered ipecacuanha with ½ gr. (30 milligrms.) of tartarated antimony.

Ipecacuanha is a specific for amœbic dysentery because emetine is a powerful poison to the amœba on which this variety of dysentery depends. If ipecacuanha itself is used large doses must be given 30 grains (2 grms.) of the powdered root in a single dose on one day, 25 grs. the next, and so on till 145 grs. have been taken. But this treatment often makes the patient sick, even in spite of giving opium or morphia to quiet the reflexes and so diminish the liability to vomiting, hence emetine or better still the hydrochloride, as it is more soluble, is usually given intramuscularly, gr. (30 milligrms.) night and morning and later on once a day.

Half a grain to a grain or more is often combined in a pill with other cholagogues to relieve cases of hepatic dyspepsia, and sometimes with excellent results.

Respiration. Ipecacuanha is a very common expectorant. Lozenges may be sucked, or the acetum or vinum may be given internally. It is suitable in cases of bronchitis or phthisis in which the secretion is scanty, and therefore there is much purposeless cough; and also when the disease is long-standing, for then the stimulation of the chronically inflamed mucous membrane will aid the cure of it. Its power of exciting the act of coughing adds to its usefulness.

The inhalation of ipecacuanha powder by means of an atomizer has been recommended in cases of asthma, and for the asthma-like paroxysms which often accompany chronic bronchitis. Sometimes it does good, but it may make the trouble worse.

Skin.—Dover's powder is very commonly used as a diaphoretic in mild feverish attacks.

LOBELIA.

Lobelia.—The dried flowering herb of *Lobelia inflata*. North America.

CHARACTERS.—The stems are angular, channelled and with narrow wings. Purple, scarred, hairy. Capsules inflated, two-celled, containing minute oblong reticulated brown seeds. Odour irritating. Taste first mild, then burning and acrid when chewed.

COMPOSITION.—The chief constituents are—(1) *Lobeline*, a liquid volatile oily alkaloid. 30 per cent. Taste pungent. Odour like tobacco. It is combined with (2) lobelic acid, and forms crystallizable salts. (3) Inflatine.

INCOMPATIBLES.—Caustic alkalies, as they decompose lobeline.

Preparation.

Tinctura Lobeliæ Ætherea.—Lobelia, 1; spirit of ether, 5. Percolate.

Dose, 5 to 15 m.—3 to 10 decimils.

ACTION.

External.—Lobelia has no effect on the skin, but it is stated that poisonous symptoms may occur from absorption of it through the epidermis.

Internal. *Gastro-intestinal tract.* Moderate or large doses are powerfully **irritant**, and cause violent vomiting and purging. These results are accompanied by very intense **prostration**, as shown by the feeble pulse, cold sweats, pale skin, and great muscular relaxation.

Circulation.—The heart is at first stimulated, but soon depressed, and it finally becomes rapid, irregular, and feeble. The blood-pressure falls. These effects on the gastro-intestinal tract and circulation are due, like those of nicotine and conine, to paralysis of nerve ganglia.

Respiration. Small doses slow respiration; large doses strongly depress the respiratory centre, and death takes place from respiratory failure. The muscular coat of the bronchi is **relaxed**.

Nervous system.—Toxic doses are required to affect the higher cerebral centres, and then coma and convulsions are produced, but it is not clear how far these results are due to asphyxia. Experiments seem to show that the motor centres of the cord are depressed. Muscles and nerves are unaffected.

Lobeline is probably excreted by the kidneys and skin, and is said to have diuretic and diaphoretic properties.

THERAPEUTICS.

Lobelia has been recommended as a purgative and as an emetic, but it should not be used for these purposes, because of its great liability to produce collapse. It is employed in asthma to relax the muscular coat of the bronchial tubes, but it is of very little use unless large doses are given and they are not to be recommended because of the severe depression they cause. It may also be prescribed for bronchitis accompanied by spasmodic dyspnœa.

VIRGINIAN PRUNE BARK.

Pruni Virginianæ Cortex. The bark of *Prunus serotina*, the wild cherry, collected in the autumn.

CHARACTERS. Curved pieces or fragments about 3 millimetres thick. Frequently smooth and reddish, with transversely elongated lenticels and short granular fracture. Taste, astringent and bitter. Odour after maceration with water like bitter almonds.

COMPOSITION. It contains (1) Amygdalin, which yields with water glucose, hydrocyanic acid, and essential oil of bitter almonds (*q.v.*). (2) Emulsin.

Preparations.

1. **Syrupus Pruni Virginianæ.**—Virginian prune bark, 150; refined sugar, 750; glycerin, 651; water to 1000. Percolate.

Dose, $\frac{1}{2}$ to 1 fl. dr.—2 to 4 mils.

2. Tinctura Pruni Virginianæ. Virginian prune bark, 200; alcohol (90 per cent.), 565; distilled water, 365; glycerin, 100. Macerate.

Dose, ½ to 1 fl. dr. – 2 to 4 mils.

ACTION AND THERAPEUTICS.

When this drug is treated with water, hydrocyanic acid is formed, and that is probably the reason why it is efficacious in relieving cough, especially a hacking cough, by which nothing is expectorated, for prussic acid diminishes reflex excitability. Virginian prune is a very favourite remedy, and the syrup is a very useful flavouring agent for cough mixtures.

GROUP IV.

Vegetable Drugs having Antiperiodic, Antipyretic, and Antiseptic Properties.

Cinchona Bark, Quinine, Salicin, Salicylates, Oil of Gaultheria, Alstonia, Berberis.

CINCHONA BARK.

Cinchonæ Rubræ Cortex. Red Cinchona Bark. The dried bark of the stem and branches of cultivated plants of *Cinchona succirubra*.

CHARACTERS.—Quills or incurved pieces, five to thirty centimetres long, two and a half to six millimetres thick, coated with periderm. Outer surface rough from longitudinal furrows, ridges, transverse cracks, annular fissures, and warts, brownish or reddish brown. Inner surface brick-red or deep reddish brown, irregularly and coarsely striated. Fracture nearly close in the smaller quills, finely fibrous in the larger. Powder brown or reddish brown. No odour. Taste bitter and astringent.

COMPOSITION.—The chief constituents of cinchona bark are four alkaloids, two acids, a glucoside, tannin, a colouring matter, and a volatile oil. (There are thirty-one cinchona alkaloids, but only four are important.)

(1) ***Quinine.***—**An alkaloid.** $C_{20}H_{24}N_2O_2$. **Exists as the hydrate.** White acicular crystals, inodorous, very bitter. Gives a green colour with chlorine water and ammonia; turns the plane of polarization to the left; solutions of its salts are fluorescent. Soluble in ether and in ammonia. Forms salts with acids. (*See* Sulphate and Hydrochloride, pp. 476 to 478.)

(2) *Quinidine.* An alkaloid. $C_{20}H_{24}N_2O_2$. Isomeric with quinine, differing from it only in crystallizing in prisms, turning the plane of polarization to the right, and not being soluble in ammonia except in excess.

(3) *Cinchonine.* An alkaloid. $C_{19}H_{22}N_2O$. Colourless prisms, inodorous, bitter. No green colour with chlorine water and ammonia. Turns the plane of polarization to the right. Not fluorescent. Almost insoluble in ether and in ammonia.

(4) *Cinchonidine.* An alkaloid. $C_{19}H_{22}N_2O$. Isomeric with cinchonine, differing from it in turning the plane of polarization to the left, being sparingly soluble in ether, and being slightly fluorescent.

Good red bark should yield 5 to 6 per cent. alkaloids, not less than half being quinine and cinchonidine. Of non-official cinchona barks, good yellow bark should yield 2·5 to 3·5 per cent. of quinine; and pale bark, very little quinine, but 0·7 to 1·4 total alkaloids, chiefly cinchonine and quinidine.

(5) *Chinic* [illegible] *quinic acid.* $C_7H_{12}O_6$. Large colourless prisms. It and its salts are soluble in water, and thus quinine may be given subcutaneously as quinate of quinine. This acid is found in the coffee bean and other plants. It is allied to benzoic acid, and appears in the urine as hippuric acid.

(6) *Chinovic acid.*—A white amorphous substance related to chinovin.

(7) *Chinovin.*—A glucoside, which easily decomposes into glucose and chinovic acid.

(8) *Cincho-tannic acid.*—1 to 3 per cent. It is the astringent principle of cinchona bark. It differs from tannic acid in striking green with per-salts of iron. It is easily oxidized to cinchona red.

(9) *Cinchona red.*—The colouring matter of the bark. It is almost insoluble in water.

(10) *A volatile oil.*—This exists in minute quantities. Cinchona bark owes its smell to it.

Remijia bark (from which quinine may be prepared) yields in addition homoquinine, which yields quinine and another alkaloid, cupreine.

Impurities.—Inferior barks, known by their not yielding the full strength of quinine and cinchonidine.

INCOMPATIBLES.—Ammonia, lime water, metallic salts, and gelatin.

The Pharmacopœia directs that the official bark, when used to make the preparations of it, should contain between **5 and 6 per cent.** of total alkaloids, of which not less than half consists of quinine and cinchonidine.

Preparations.

1. **Extractum Cinchonæ Liquidum.**—Red cinchona bark powdered, 1000; hydrochloric acid, 31; glycerin, 125; alcohol (90 per cent.), q.s.; distilled water, q.s. *Standardized to contain 5 per cent. of total alkaloids, or 5 gr. in 110 m.*

   Dose, 5 to 15 m. 3 to 10 decimils.

2. **Infusum Cinchonæ Acidum.** Red cinchona bark, 1; aromatic sulphuric acid, ¼; boiling water, 20. This is a solution of the sulphates of the alkaloids.

   Dose, ½ to 1 fl. oz.—15 to 30 mils.

3. **Tinctura Cinchonæ.**—Red cinchona bark, and alcohol (70 per cent.). Percolate. *Standardized to contain 1 per cent. of total alkaloids, 1 grm. in 100 millilitres, or 1 gr. in 110 m.*

   Dose, ½ to 1 fl. dr.—2 to 4 mils.

4. **Tinctura Cinchonæ Composita.** Tincture of cinchona, 500; dried bitter orange peel, 50; serpentary, 25; cochineal, 3; alcohol (70 per cent.), to produce 1000. Mix. *Standardised to contain 0·5 per cent. of total alkaloids, 0·5 grm. in 100 millilitres, or ½ gr. in 110 m.*

   Dose, ½ to 1 fl. dr.—2 to 4 mils.

It will be noticed that all preparations of cinchona bark are directed by the Pharmacopœia to be made from red cinchona bark, but quinine salts may be made from various kinds.

Quininæ Sulphas.—Quinine Sulphate. $([C_{20}H_{24}N_2O_2]_2H_2SO_4)_2,7\frac{1}{2}H_2O$.

SOURCE.—The sulphate of an alkaloid, quinine, prepared from the powder of the various species of cinchona bark.

CHARACTERS.—Filiform, silky, very light, snow-white crystals, with an intensely bitter taste. *Solubility.*—1 in 800 of water, and giving it a fluorescent, bluish tinge; easily in slightly acidulated water (1 m of a mineral acid in 2 fl. oz. of water will dissolve 1 gr. of sulphate of quinine), but spre pitated by ammonia; the precipitate is soluble in excess of mmonia and in ether; 1 in 65 of alcohol (90 per cent.)

IMPURITIES.—It should not contain more than 3 per cent. cinchonidine, and no cinchonine, quinidine, or cupreine. ime, chalk, magnesia, starch, and other white powders. cein, detected by its giving a blood-red colour with H_2SO_4.

INCOMPATIBLES.—Alkalies and their carbonates, astringent fusions.

Dose, 1 to 10 gr. 6 to 60 centigrms.

Preparations.

1. **Ferri et Quininæ Citras**, *see* Iron, p. 196.

Dose, 5 to 10 gr.—3 to 6 decigrms.

2. **Pilula Quininæ Sulphatis.**—Quinine sulphate, 82; glycerin, 12; tartaric acid, 3; tragacanth, 3.

Dose, 2 to 8 gr.—12 to 50 centigrms.

3. **Syrupus Ferri Phosphatis cum Quinina et Strychnina.**—Each fl. dr. represents $\frac{4}{5}$ gr. of quinine sulphate (*see* pp. 193, 194).

Dose, $\frac{1}{2}$ to 1 fl. dr.—2 to 4 mils.

4. **Tinctura Quininæ Ammoniata.**—Quinine sulphate, 2; solution of ammonia, 10; alcohol (60 per cent.), 90. Mix.

Dose, $\frac{1}{2}$ to 1 fl. dr.—2 to 4 mils.

Quininæ Hydrochloridum.—Quinine Hydrochloride. $C_{20}H_{24}N_2O\,HCl,2H_2O$.

SOURCE.—The hydrochloride is obtained from quinine.

CHARACTERS.—Crystals resembling those of the sulphate, t larger. *Solubility.*—1 in 35 of cold water, 1 in 3 of alcohol 90 per cent.). Very soluble in boiling water or boiling cohol. Its solution gives a green colour with chlorine water nd ammonia.

Dose, 1 to 10 gr.—6 to 60 centigrms.

Preparations.

1. **Tinctura Quininæ.** Quinine hydrochloride, 2; tincture of orange, 100. Dissolve.

Dose $\frac{1}{2}$ to 1 fl. dr.—2 to 4 mils.

2. **Vinum Quininæ.**—Quinine hydrochloride, 2; orange wine, 875.

Dose, $\frac{1}{2}$ to 1 fl. oz.—16 to 30 mils.

Quininæ Hydrochloridum Acidum.’—Acid Quinine Hydrochloride. $C_{20}H_{24}N_2O_2,2HCl$.

CHARACTERS. The acid hydrochloride is a white crystalline powder, soluble in less than its own weight of water and yielding an acid liquid.

Dose, 1 to 10 gr.—6 to 60 centigrms.

ACTIONS OF CINCHONA BARK AND ITS ALKALOIDS.

The action of cinchona bark is due almost entirely to the **quinine** in it; the other alkaloids act in much the same way as this alkaloid, the sulphate and hydrochloride of which produce the same effect as quinine itself. The following description will be that of the action of quinine sulphate, which is often called quinine. Any differences between it and the bark or the other alkaloids will be mentioned in the course of this description.

External. Quinine is a very powerful **antiseptic.** A solution of 1 in 500 destroys many forms of micro-organisms, and a solution of 1 in 250 prevents fermentation and putrefaction. Quinine is very fatal to almost all low forms of animal and vegetable life. A solution of 1 in 1000 kills many infusoria. No effect is produced upon the sound skin by quinine, but it is irritant to a raw surface.

Internal. *Alimentary canal.*—Quinine acts like any other bitter, such as calumba. The bitter taste is very marked; in the mouth the gustatory nerves, and in the stomach the gastric nerves are stimulated. This leads reflexly to an increase of the salivary and gastric secretions, and to greater vascularity and peristalsis of the stomach, the appetite is sharpened, and digestion is aided. Quinine is, therefore, a **stomachic.** These effects, of course, bring about a better absorption of food; and hence, if digestion was previously feeble, the patient feels stronger after a course of quinine. In the stomach any salt of quinine is converted into a chloride, some of which is absorbed there. In the intestines it is probably precipitated by the alkaline secretions; but as quinine is soluble in alkaline waters if aerated, perhaps some of it remains in solution. It is often excreted unchanged in the fæces.

Blood.– Quinine, as a chloride, is readily absorbed into the blood; and although this is alkaline, it is not precipitated, being probably held in solution as carbonate of quinine by the gases of the blood. It is not known to undergo any alteration there, but it produces some remarkable changes in blood.

(*a*) *White corpuscles.* If the movements of the white corpuscles are being watched in a drop of blood on the warm stage of the microscope, and some quinine is added, they at once cease. Again, if the mesentery of a living frog be put under the microscope, and slightly irritated so as to set up inflammation, emigration of the white corpuscles through the capillary walls, or diapedesis, as it is called, will be observed; if now some quinine be injected into the circulation this ceases, but those white corpuscles that have already passed out wander further from their capillary. If the quinine be applied locally to the mesentery, directly the white corpuscles have passed through their capillary their movement is stopped, and the motionless corpuscles collect in large numbers around the capillaries. It is clear, therefore, that quinine has the power of **arresting the movements of white blood-corpuscles.** In sufficient quantity it appears actually to destroy them, for in a cat killed by quinine they are much fewer in number than in a healthy cat.

(*b*) *Red corpuscles.*—Quinine is said to cause a diminution in the size of these, but this is most likely not strictly correct. In fever, if the temperature is high, the red corpuscles are probably a little larger than natural. If the temperature be reduced by any means the corpuscles regain their normal size. Quinine will reduce the temperature, but it probably has no special action on the corpuscles.

(c) *Acidity of the blood.* —Blood outside the body gradually becomes acid. Quinine prevents this.

(d) *Ozonizing power.* If ozonized oil of turpentine be mixed with tincture of guaiacum, nothing occurs; but if a drop of blood be added, that transfers the ozone to the guaiacum, oxidizes it, and turns it blue. This ozonizing power of blood is prevented by the addition of quinine.

(e) *The stability of oxyhæmoglobin* is strengthened by quinine, so that the blood does not yield up its oxygen as easily as normally. Consequently it cannot absorb oxygen readily. This inability of hæmoglobin to take up oxygen in the presence of quinine is parallel with its action on other varieties of protoplasm. For example, fungi absorb oxygen slowly if quinine be present, and thus fermentation may be prevented. Phosphorescent infusoria (the phosphorescence is due to rapid oxidization) lose this property in the presence of quinine. The ozonizing power of fresh vegetable juices is retarded by it. Quinine is, therefore, very constant and very powerful in interfering with oxidation.

Circulation. Small doses of quinine probably increase the activity of the heart reflexly because they stimulate the stomach; but large doses (larger than are given to man medicinally), either applied to the excised heart or circulating through it, directly paralyse the organ; the pulse becomes slower and more feeble, and the heart is finally arrested in diastole. Whether it acts on the muscle or the ganglia is not known. Large doses lower the blood-pressure considerably; this is owing partly to the effect on the heart, but it is probable that this fall of arterial pressure is due in part also to the action of quinine on the blood-vessels. If the spleen is enlarged as a result of malarial fever, the administration of quinine, curing the fever, leads to a decrease in the size of the spleen, but it has no direct effect on this organ, as is often asserted.

Respiration. Although, as we have seen, quinine must, because of its retardation of oxidation, have a powerful influence on internal respiration, diminishing the activity of metabolism, it has but a moderate effect on the respiratory movements. Small doses slightly increase, large doses depress them.

Temperature. Quinine has very little power over the healthy temperature, but that of fever is markedly reduced; it is, therefore, an energetic **antipyretic**. Considering its direct capability of diminishing metabolism in the tissues, it seems fair to assume that the drug **diminishes heat production**, and that it does so by acting directly on the thermogenetic tissues; but, whether it decreases heat production by also influencing the cerebral thermogenetic centres is not known.

Cerebrum.—Small doses are believed to stimulate cerebral activity. The results of experiments upon the action of quinine on the brain are so discordant as to be at present valueless. The effects of a large dose in man will be described under Cinchonism.

Spinal cord and nerves. In frogs quinine causes a lessening of reflex excitability, which is removed by section below the medulla; but in large doses it produces a permanent diminution of reflex excitability. In these animals quinine also first excites and then paralyses the sensory nerves or their peripheral endings. The muscles are uninfluenced. These effects are not seen in man.

Uterus.—It has often been stated that quinine will lead to abortion, that it will when labour has commenced aid the expulsion of the fœtus, and that it will increase the menstrual flow if that is scanty. It appears that the first statement is certainly incorrect, and that the second and third are correct only for some women.

Kidneys. – After a full dose of quinine it is found in the urine in half an hour, and is slowly excreted for several days, but by far the greater part is eliminated within the first forty-eight hours. The excretion of uric acid, urea, and sulphur in the urine is greatly diminished, from which we learn that quinine retards considerably the protein metabolism of the body, but it should be stated that very little alteration is observed in the absorption of oxygen and excretion of carbonic acid gas by the lungs. It is said that minute quantities of quinine are got rid of by all the secretions, as it may be detected in milk, saliva, bile, and tears, and it may be found in dropsical fluids if the patient has been taking it.

Cinchonism.– In many persons a dose of ten grains or more of quinine produces a train of physiological symptoms, chiefly from its influence on the nervous system. The patient soon complains of ringing in the ears, fulness in the head, and slight deafness. With larger doses these symptoms increase, disturbances of vision and giddiness are added, he may stagger when he walks, and the headache may be very intense.

Quinine is hardly ever given as a poison, but if it should be, all these symptoms of cinchonism will be very severe; the patient may be delirious and comatose, quite deaf and blind, and if he die it will be from collapse due to cardiac and respiratory failure. Great congestion of the middle ear and labyrinth is found in animals poisoned by quinine. The mild degrees of cinchonism pass off directly the drug is discontinued. Rarely quinine causes an erythematous rash, and it may give rise to epistaxis and other hæmorrhages. Those who work among cinchona barks may have a rash on their skin from the mechanical irritation of the powder.

Relative Action of the Alkaloids.—The other alkaloids are quite similar in their action to quinine, but they are not so powerful. Their relative antipyretic effect is quinine 100, quinidine 90, cinchonidine 70, cinchonine 40.

THERAPEUTICS.

External. Quinine is too expensive for use as an antiseptic.

Internal.—*Gastro-intestinal tract.* It is very largely used on account of its stomachic properties, chiefly for that variety of indigestion which is the outcome of general ill health, want of fresh air, and anæmia, and not often when the stomach is the organ primarily at fault. The preparations of cinchona bark are very useful for this variety of dyspepsia; they contain quite enough of the alkaloids. The compound tincture has the advantage of containing other stomachics. Iron is very commonly given at the same time to correct the general condition. Quinine is frequently prescribed with the tincture of perchloride of iron, there is always enough free acid in this to dissolve any preparation of quinine. Alkalies, especially sal volatile, are often prescribed with solutions of sulphate of quinine, but they precipitate the quinine, and therefore mucilage must be used to suspend it. The dose of the sulphate or hydrochloride of quinine as a stomachic bitter is ½ to 2 gr. (3 to 12 centigrms.). The acid hydrochloride is often preferable, as it is more soluble.

Antipyretic effect.—Quinine was commonly used as an antipyretic, but for the rare occasions on which antipyretic drugs are required, it has now been replaced by those which are more certain, as phenacetin, acetanilide, and phenazone. It is, however, a very fairly certain antipyretic. It is best given for this purpose in a single dose of 20 to 40 grains (12 to 24 decigrms.) for an adult. Such large doses may be prescribed either in cachets, or as a solution of the hydrochloride, or as the sulphate suspended in milk. About one or two hours elapse before the temperature begins to fall. Quinine is more efficacious in reducing a temperature just beginning to fall than a rising one. Hence if possible it should be administered an hour or two before the time at which previous experience of the particular case shows the temperature will probably attain its maximum; then the fall will be more marked and last longer than if the drug had not been given.

Specific action.—Quinine, and to a less extent the other cinchona alkaloids, have the remarkable property of arresting the paroxysms of malarial fever. If 15 to 30 grains (1 to 2 grms.) be taken about one or two hours before the attack is due, it will not take place, or it will be very mild. The same effect will be produced if smaller doses, about 5 grains (3 decigrams) have been taken four or five times a day during the period between the attacks. Not only is it thus prophylactic, but the continued use of it is curative. It is also preventive, even if the persons to whom it has been given have never had ague. For this purpose it is administered to soldiers and sailors who have to enter malarious regions, and it is then found that few of them get ague. If the disease is very severe it is best to give single large doses.

If a person has once had ague, illnesses that he subsequently suffers from are liable to assume a malarial type. This is especially the case with neuralgia, which is then peculiarly paroxysmal. It is often on the forehead, when it is called brow ague. In such illnesses the effect of quinine is frequently very well marked, and a cure speedily takes place. Sometimes neuralgia which is not malarial is temporarily benefited. Quinine cures ague by acting, while circulating in the blood, as a direct poison to the hæmatozoa (protozoa), which infest the blood and are the cause of ague. Different forms of ague or malaria are due to different but closely allied parasites. Tertian and quartan parasites are more readily affected than quotidian and malignant. Quinine has been given for a host of diseases, especially septicæmia, but there is no evidence that it does good to any, except those mentioned.

It has been stated that quinine, given to those who have malaria, causes blackwater fever; therefore it is doubtful whether quinine should be used for this disease.

The preparations of the bark contain so little quinine that they cannot be used as antipyretics or antiperiodics.

Quinine should if possible be avoided in (1) persons suffering from acute or subacute disease of the middle ear; (2) those suffering from gastro-intestinal irritation, which it may increase; (3) those people, occasionally met with, in whom quite small doses produce very severe symptoms of cinchonism.

Both hydrobromic acid and ergotin are said to diminish the liability to cinchonism.

If it is wished to give quinine hypodermically, the best salts are the lactate (soluble 1 in 5 of water) or the official acid hydrochloride: 6 to 30 ♏ (4 to 18 decimils) of a solution of 1 gr. (6 centigrms.) of either in 6 ♏ (36 centimils) of water may be used.

Warburg's tincture is a medicine which has a very high reputation in India for malaria. It has been called Tinctura Antiperiodica. The published formula states that it is a tincture made with alcohol (57 per cent.), and containing quinine sulphate, 1 in 50; Socotrine aloes, 1 in 40; opium, 1 in 1000; rhubarb, 1 in 125; camphor, 1 in 500, with angelica seed, elecampane, saffron, fennel, gentian, zedoary, cubebs, myrrh, and white agaric as aromatics. Dose, 1 to 4 fl. dr. (4 to 16 mils). It is often prescribed to be made without the aloes.

SALICIN.

Salicinum.—C H O. A crystalline glucoside obtained from the bark of various species of *Salix* and of *Populus*.

Characters.—Colourless, shining, trimetric, tabular crystals of a bitter taste. Coloured red with sulphuric acid. *Solubility.*—1 in 28 of cold water, 1 in 1 of boiling water, 1 in 80 of alcohol (90 per cent.). Not in ether.

Dose, 5 to 20 gr.—3 to 12 decigrms.

Acidum Salicylicum. Salicylic Acid. *Synonym.*—Orthohydroxybenzoic acid. HC H O

Source.—Made from natural salicylates, such as the oil of winter-green *Gaultheria procumbens*, which contains methylsalicylate, or the oil of sweet birch, *Betula lenta*; or it may be made by the interaction of sodium phenate and carbon dioxide.

Characters.—Distinct, prismatic, colourless crystals. Inodorous. Taste first sweetish, then acid. Light, easily diffused, irritating to the nostrils. Melt at 156° C. *Resembling salicylic acid.*—Strychnine, but the crystals of strychnine are larger, non-irritating, less soluble, solution very bitter. *Solubility.*—1 in 500 of water. Readily in alcohol, ether, hot water, solutions of ammonium citrate, ammonium acetate, sodium phosphate, or borax. The natural acid is not quite so soluble as the artificial. Aqueous solutions give a reddish violet colour with perchloride of iron.

Incompatible.—Spirit of nitrous ether.

Impurities.—Orthocresotic, metacresotic, and paracresotic acids. These exist only in artificial salicylic acid. In the best specimens they are absent.

Dose, 5 to 20 gr.—3 to 12 decigrms.

Preparation.

Unguentum Acidi Salicylici.—Salicylic acid, 1 gr.; white paraffin ointment, 49 gr.

Salicylic acid is contained in Injectio Cocainæ Hypodermica.

Sodii Salicylas.—Sodium Salicylate. NaC H O

Source.—Obtained by acting on sodium carbonate with salicylic acid.

Characters.—Small colourless scales or pearly tabular crystals. Odour none. Taste sweetish saline. *Solubility.*—1 in 1 of water (but when this solution stands the salt containing 6 molecules of water of crystallisation may be deposited), 1 in 6 of alcohol (90 per cent.).

Incompatible.—Hydrobromic acid, for sodium bromide is formed and salicylic acid is precipitated.

Impurities.—As of salicylic acid.

Dose, 10 to 30 gr. - 6 to 20 decigrms.

Methyl Salicylas. Methyl Salicylate. It contains not less than 98 per cent. of pure methyl salicylate, $CH_3C_7H_5O_3$. *Synonym.*—Artificial oil of wintergreen or sweet birch.

Source.—Obtained by the interaction of methyl alcohol and salicylic acid. (It is the chief constituent of oil of wintergreen and oil of sweet birch.)

Characters.—A colourless liquid, aromatic odour, warm sweetish taste, almost insoluble in water, readily in alcohol; coloured violet by ferric chloride.

Dose, 5 to 15 m. 3 to 10 decimils.

Acidum Acetylsalicylicum. Acetylsalicylic Acid, $C_9H_8O_4$. *Synonym.*—Aspirin.

Source.—May be obtained by the action of acetic anhydride or of acetyl chloride on salicylic acid.

Characters.—A white, crystalline powder; taste slightly acid. Sparingly soluble in water.

Dose, 5 to 15 gr. 3 to 10 decigrms. best in cachet or tablet.

For Bismuthi Salicylas *see* p. 188, and for Salol *see* p. 193.

ACTION OF SALICIN AND SALICYLATES.

External.—Salicin and salicylic acid are **antiseptics** rather more powerful than carbolic acid. They are stimulant and mildly irritant to the skin. Locally applied they **check sweating.** Sodium salicylate is less antiseptic. Salicylic acid softens and removes epithelium. Methyl salicylate is rapidly absorbed when rubbed into the skin.

Internal.—*Alimentary tract.* When inhaled or applied to the throat, salicylic acid is irritating, causing sneezing and coughing. In the stomach also it is irritant, giving rise to pain, nausea, and vomiting unless well diluted, and should therefore never be given as pill or powder. The sodium salt and salicin are much less irritating and acetyl-salicylic acid still less, for, being insoluble in acids, it is not acted on till it reaches the intestines where it is dissolved by the alkaline secretions. The glucoside salicin is in the bowel converted into glucose and saligenin, $C_7H_8O_2$, and this is further decomposed into salicylic acid, salicyluric acid, $HC_9H_8NO_4$, and salicylous acid, $HC_7H_5O_2$. The bile is rendered much less viscid.

Blood.—Salicylic acid, whether taken directly or formed in the bowel from the decomposition of salicin, is rapidly absorbed in spite of its insolubility, and therefore it is probably taken up as sodium salicylate: anyhow, this is the form in which it circulates in the blood, and consequently the following description will apply whether salicin, salicylic acid, or sodium salicylate has been taken. It has been thought also to exist in the blood as an albuminate, but of this there is no evidence, nor for the theory put forward by Binz, that when the sodium salicylate meets with carbonic acid, either in the blood or in the inflamed tissues of rheumatic fever, salicylic acid is set free. Some of the salicylic acid of the sodium salt unites with glycocoll, forming salicyluric acid, which appears in the urine. Thus: $HC_7H_5O_3 + C_2H_5NO_2$ (glycocoll) $= HC_9H_8NO_4$ (salicyluric acid) $+ H_2O$. It will be noticed that this change is precisely analogous to the conversion of benzoic into hippuric acid by its union with glycocoll. The beneficial germicidal effect of this acid is well seen in a disease of bees known as foul brood, and due to certain schizophytes, for feeding the bees on syrup containing salicylic acid cures them.

Liver.—It is of interest that sodium salicylate, like sodium benzoate, probably increases both the amount and the solids of the bile.

Heart.—Salicin and salicylic acid are often stated to depress the force of the heart and cause a fall of blood-pressure. Careful comparison shows that salicin is not nearly so depressant as the acid—in fact, it is probable it has not this action at all unless given in toxic doses. Further, natural salicylic acid is not so depressant as some specimens of the artificial variety. For example, Charteris found that 30 grains (2 grms.) of salicin, or 10 grams (6 decigrms.) of natural salicylic acid, or 32 grains (21 decigrms.) of natural sodium salicylate had no injurious effect on a rabbit, but that much smaller doses than these of the artificial acid or its salt killed the animal. The artificial variety was found to contain orthocresotic and paracresotic acids, and the former is a powerful **cardiac depressant**. Thus it seems probable that the depressing effects commonly ascribed to salicylic acid are really due to the impurities occasionally present in the artificial form. Salicylic acid increases the blood-pressure from stimulation of the vaso-constrictor centre.

Respiration. Moderate doses have very little effect on respiration. Toxic doses strongly depress it.

Temperature.—In medicinal doses salicin and salicylic acid have no influence on the temperature of man, in toxic doses they slightly lower it; but they readily depress a febrile temperature, and are therefore called **antipyretics**. They cause a slight increase of perspiration, but this is not sufficient to explain the fall.

Salicylic acid and salicin are **antiperiodic**.

Nervous system.—We know little of the effect of salicylic acid on the individual parts of the nervous system. The clinical symptoms known as salicylism will be described presently.

Kidney.—Salicylic acid escapes chiefly through the kidneys. It to a much less extent also leaves the body by the sweat, the saliva, the bronchial secretions, and the fæces. It appears in the urine very soon after its ingestion (in from 10 to 30 minutes), but the elimination goes on slowly. **It is excreted** as salicyluric acid and sodium salicylate, which is split up by the phosphoric acid in the urine, yielding salicylic acid. The dark greenish colour of the urine sometimes seen is due to small quantities of either indican or pyrocatechin. Occasionally salicylic acid causes hæmaturia, due to congestion of the kidneys.

Salicylic acid **increases protein metabolism,** hence the total nitrogen and sulphur in the urine are increased. The quantity of uric acid is particularly great. It renders the **urine antiseptic,** and the salicyluric acid in that fluid will reduce Fehling's solution. The urine of patients taking it gives a **purple colour** with **perchloride of iron.**

Uterus.—It may cause abortion.

Salicylism. In some persons to whom salicylic acid or its salt is given a train of symptoms is produced to which the above name has been applied. They are very like those produced by quinine. The cause of at least some of them is the impurities existing in artificial salicylic acid, but it is stated that the natural acid may very rarely give rise to them. Orthocresotic acid is certainly toxic, metacresotic acid has no action, and it is doubtful whether paracresotic acid is toxic. The commonest symptom is deafness, which is often accompanied by ringing in the ears. Headache is also very frequent. The administration of the drug is usually stopped when these symptoms show themselves, but if it is continued the patient becomes violently delirious, there is nausea and vomiting, the face is flushed, and the other symptoms increase in severity. The pulse falls in both frequency and force, it becomes irregular, epistaxis is common, and hæmorrhages from other parts of the body have been recorded, such as hæmaturia and retinal hæmorrhage. Albuminuria without hæmaturia has been observed. One of the rarest symptoms is erythema or urticaria. Very large doses may cause the breathing to become weaker, and death may take place either from cessation of the heart or of the respiratory movements.

THERAPEUTICS.

External.—The ointment may be used when an antiseptic stimulating ointment is required. A collodion composed of salicylic acid, a drachm, collodium flexile, an ounce; a glycerin containing 10 per cent. of salicylic acid; and a plaster [illegible]o 10 per cent., are good preparations. Strong ap[illegible]ns of salicylic acid are very useful for removin[illegible]ess of epidermis, warts, or corns. Salicylic acid [illegible] parts, Extract of Cannabis Indica 2 parts, Collodion flexile 87 parts, form an excellent remedy (commonly known as green solution) for soft corns. Powdered salicylic acid mixed with starch or chalk may be employed to check profuse perspiration of the feet and axillæ. The German Pharmacopœia has for this purpose a Pulvis Salicylicus cum Talco (salicylic acid, 3; wheaten starch, 10; talc, in powder, 87). The sweats of phthisis may be treated in the same way. A little salicylic acid is often added to Thompson's fluid (pp. 280-281). A preparation called "Antiphlogistine" is much used externally to relieve pain. It is said to be composed of glycerin, salicylic acid, boric acid, ferrous carbonate, peppermint, gaultheria, eucalyptus, and iodine, combined with an earthy base.

Methyl salicylate is very useful when rubbed in for chronic rheumatism or lumbago; an ointment of 1 in 2 to 4 of lanolin may be used, and a liniment (Linimentum Methylis Salicylatis B. P. C.) containing menthol, 5; oil of eucalyptus, 10; essential oil of camphor 25; methyl salicylate to 100, is of value when painted on the painful parts and covered with flannel or gutta percha.

Internal.—Salicylic acid is a specific for rheumatic fever; it lowers the temperature, lessens the swelling, leads to a rapid cessation of pain, and diminishes the liability to pericarditis and other complications. It must be given well diluted to prevent dyspepsia. The sodium salt is often preferred as being the most soluble, but in order to diminish the risk of salicylism it should be prepared either from pure artificial or from natural salicylic acid. If the attack is severe, 20 grains every two or three hours should be given for the first twelve or twenty four hours; then, if the patient is doing well, the frequency of the dose may be gradually diminished, but it should be continued thrice daily for ten days after the temperature is normal and the pain has ceased. The micro-organism which is the cause of rheumatic fever forms formic acid, which is excreted by the sweat and urine. The formation of this acid is controlled by the administration of salicylic acid. Salicin is not so powerful as sodium salicylate, but it is said to be less depressant than the synthetic acid.

These preparations are of no use for gout or severe osteo-arthritis, but occasionally the pains of chronic rheumatism, sciatica, migraine, and painful menstruation are somewhat relieved, acetyl salicylic acid is largely used for these disorders. With some persons it acts as an hypnotic.

Salicylic acid or salicin may produce a fall of temperature in any fever, but, as we have more certain antipyretics, they are not used except for rheumatic fever.

Some writers have found salicylic acid useful in diabetes

It has been given to render the urine acid in cases lkaline urine and cystitis, but there are better medies for this purpose.

s also been given in cases of gallstone with the object of rendering the bile less viscid.

OIL OF GAULTHERIA.

Oleum Gaultheriæ. *Synonym.*—Oil of wintergreen. The oil distilled from the leaves of *Gaultheria procumbens*, or from the bark of *Betula lenta*. It contains not less than 99 per cent. of esters calculated as methyl salicylate $CH_3C_7H_5O_3$.

Characters.—Colourless or slightly yellowish. Odour characteristic.

Dose, 5 to 15 m. 3 to 10 decimils.

Officially used in North American Colonies.

Action and Therapeutics.

The action and uses of this oil are exactly the same as those of other salicylates. It is used chiefly in the North American Colonies.

Mesotan.—(Not official.) Methoxymethyl ester of salicylic acid. A pale yellow fluid. Mixed with oil and when painted on the skin is quickly absorbed. It has been applied for chronic rheumatism but without much benefit. A usual formula is equal parts of mesotan and olive oil lightly rubbed in or painted on with a camel's-hair brush. It is not to be recommended as it may cause a severe dermatitis.

SALOL.

Salol.—Phenyl salicylate. $C_{13}H_{10}O_3$.

Source.—Prepared by the interaction of salicylic acid and phenol.

Characters and Tests.—Small colourless crystals of a faint aromatic odour and almost tasteless. *Solubility.* Not in water; 1 in 15 in alcohol (90 per cent.), 3 in 1 in ether or chloroform. Contains 60 parts of salicylic and 40 of carbolic acids.

Dose, 5 to 20 gr.—3 to 12 centigrms. in cachets or suspended. The large quantity of carbolic acid in salol renders caution necessary when large doses are given.

Action and Therapeutics.

External.—It is an antiseptic, and when mixed with talc (1 in 5) may be used as a dusting powder.

Internal.—In the intestine salol splits up into carbolic and salicylic acids, and the former may render the urine dark. A good mouth wash consists of salol 2·5, saccharin 0·001, peppermint oil 0·5, alcohol (80 per cent.) 97, with clove and caraway oil added.

In rheumatic fever it is efficacious on account of the salicylic acid it contains, but it has no advantage over salicin or salicylic acid, and the carboluria may be troublesome. It is used as an intestinal disinfectant. These have been discussed when describing naphthol (p. 347) and on p. 100. It disinfects the urinary tract. The following is a good way of prescribing it: Salol, gr. 10 (6 decigrms.); almond oil, ♏ 20 (12 decimils); powdered acacia, gr. 10 (6 decigrms.); syrup, ♏ 20 (12 decimils); water, 4 fl. dr. (15 mils). The emulsion should be made in a warm mortar with water at 65°C.

ALSTONIA.

Alstonia.—The dried bark of *Alstonia scholaris* and *Alstonia constricta*.

Characters.—The bark of *A. scholaris* is in fragments 3 to 12 mm. thick; spongy texture; externally rough, and brownish grey; internally bright buff; taste bitter. That of *A. constricta* is in curved pieces or quills 60 mm. wide, 12 mm. thick; rusty brown externally, cinnamon colour internally.

Used chiefly in India, Australasian Colonies, and Eastern Colonies.

Preparations.

1 **Infusum Alstoniæ.**—Alstonia, 1; boiling water, 20.

Dose, ½ to 1 fl. oz.—15 to 30 mils.

2. **Tinctura Alstoniæ.**—Alstonia, 125; alcoho (60 per cent.), 1000. Macerate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

ACTION AND THERAPEUTICS.

A. scholaris grows in the Philippines, where it is called 'Dita bark.' It contains many alkaloids, the best known being ditaine, which paralyses motor centres, motor nerves, and vagi of frogs, and in mammals paralyses motor nerve endings.

A. constricta grows in Australia, and is there called Australian fever bark. Its most active body is alstonine. Both varieties are used in dysentery, chronic diarrhœa, and intermittent fever, during the disease as well as during convalescence. Both have been employed as anthelmintics.

BERBERIS.

Berberis. The dried stem of *Berberis aristata.*

CHARACTERS.—Undulating pieces, two and a half to five centimetres in diameter, covered with orange brown periderm. The wood is bright yellow. Faint odour. Bitter taste.

Preparation.

Tinctura Berberidis.—1 in 10 of alcohol (60 per cent.). Percolate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

ACTION AND THERAPEUTICS.

The drug is largely used in the various forms of remittent fever, but it is far inferior to quinine. It is also given as a diaphoretic and diuretic. An extract of it, known as rasot, is used as a paint in chronic ophthalmia. The chief alkaloid is berberine.

GROUP V.

Vegetable Purgatives.

Class I.—Laxatives.
Tamarinds, Cassia, Castor Oil (small doses).

Class II.—Simple purgatives.
Castor Oil, Rhubarb, Purgatin, Purgen, Senna, Cascara Sagrada, Aloes.

Class III.—Drastic purgatives.
Scammony, Ipomœa Root, Jalap, Croton Oil, Colocynth.

Class IV.—Cholagogues.
Podophyllum, Euonymus Bark, Iridin.

Class I.—Laxatives.

TAMARINDS.

Tamarindus. The fruit of *Tamarindus indica* freed from the brittle outer part of the pericarp and preserved with sugar. West Indies.

Characters.—A reddish-brown, moist, sugary mass, enclosing strong-branched fibres, and brown, shining seeds, each enclosed in a tough membranous coat. Taste agreeable, refreshing, subacid.

Impurity.—Copper.

Composition. The chief constituents are—(1) Tartaric acid and potassium tartrate. (2) Citric, acetic, and other acids. (3) Sugar.

Tamarind is contained in Confectio Sennæ, 9 in 75.

Action and Therapeutics.

Tamarind is pleasant and acid to the taste, and a mild laxative. It may be made into tamarind whey (1 part of tamarinds to 80 of milk) and given as an acid, cooling, slightly purgative drink in fevers. It is a good purgative for children, and may be spread on bread and butter.

CASSIA PODS.

Cassiæ Fructus.—The ripe fruits of *Cassia Fistula*, the purging cassia.

Characters.—Long, narrow, cylindrical, shortly stalked fruits, 35 to 50 centimetres long, 15 to 25 millimetres in diameter. Pericarp nearly smooth, dark brown or nearly black; thin and hard. Internally divided by thin transverse dissepiments into numerous compartments, each of which contains a smooth, oval, reddish brown seed surrounded by nearly black, sweet pulp.

CASSIA PULP.

Cassiæ Pulpa. The pulp obtained from the crushed pods of *Cassia Fistula* by percolation with distilled water and evaporation to the consistence of a soft extract.

Composition. The chief constituents are (1) A purgative principle closely allied to cathartic acid. (*See* Senna, p. 503.) (2) Sugar 60 per cent.

Cassia pulp is contained in Confectio Sennæ, about 1 in 75.

Action and Therapeutics.

It is a laxative, only given in confection of senna.

Class II.—**Simple Purgatives**

CASTOR OIL.

Oleum Ricini.—The fixed oil expressed from the seeds of *Ricinus communis*. India.

Characters. Viscid, colourless or pale yellow. Odour faint, characteristic. Taste slight but unpleasant. Sp. gr. 0·958 to 0·970. *Solubility.* 1 in 1 of absolute alcohol, 1 in 3·5 of alcohol (90 per cent.). These are the characters of the pure oil expressed in the cold. Much that is sold is expressed by the aid of heat. This is dark in colour and very nasty.

Composition.—The chief constituents are—(1) *Ricinoleate of glyceryl*, $C_3H_5(C_{18}H_{33}O_3)_3$. This constitutes the chief bulk. (2) Other fixed oils, as palmitin, stearin, &c. (3) Possibly an alkaloid, ricinine, not purgative. (4) According to some authorities an active principle which has not yet been isolated.

Dose, 1 to 8 fl. dr.—4 to 30 mils.

Preparation.

Mistura Olei Ricini.—Castor oil, 375; orange flower water of commerce, 150, gum acacia, 100 cinnamon water to 1000. (Contains nearly 3 fl. dr. o castor oil in 1 fl. oz.)

Dose, 1 to 2 fl. oz.—30 to 60 mils.

Castor oil is contained in Collodium Flexile, Linimentum Sinapis, and Pilula Hydrargyri Subchloridi Composita (Castor-oil seeds are not official, but it is important t recognise them. They are $\frac{3}{5}$ in. long and $\frac{1}{3}$ in. wide, ovoid flattened. The seed is prolonged into a sharp beak Epidermis shiny grey, marked by brownish bands and spots Kernel white. They contain 50 per cent. of the oil, and a acrid substance which makes them poisonous. Three castor oil seeds have been known to kill an adult man.)

ACTION.

External.—Castor oil is, like olive oil, protective and sedative, and may be used to drop into the eye when the conjunctiva is inflamed, and as a solvent for homatropine, but this solution is occasionally a little irritating.

Internal.—*Gastro-intestinal tract.*—The nastiness of castor oil is mostly due to the smell, and is not noticed much if the nose is held when the oil is drunk. Medicinal doses produce no effect on the stomach. Reaching the intestine the oil is an excellent **simple laxative** or mild purgative, acting in about five hours, and causing no griping nor subsequent constipation. The motion is soft but not liquid. Castor oil will purge even when rubbed into the skin. The ricinoleate of glyceryl in the oil is decomposed in the duodenum, and the ricinoleic acid purges. Castor oil will purge when given *per rectum.*

Mammary glands.—Applied locally to the breasts it is said to be **galactagogue.**

THERAPEUTICS.

Castor oil is perhaps the best simple purgative we have, and is very useful in cases in which there is slight temporary constipation. Being mild in its action it is very suitable for getting rid of undigested food that is causing diarrhœa, and a dose of castor oil with a minute quantity of laudanum in it is a favourite remedy for certain forms of diarrhœa. It is also especially convenient in pregnancy, after delivery, and when in any abdominal disease, as typhoid fever, peritonitis, or when, after abdominal operations, the irritation caused by the fæces makes it absolutely necessary to get the bowels open. Also it is very useful for children, or for very old or infirm persons, or for those suffering from piles or fissures. It is a good purgative to give before and after the use of anthelmintics, and taken daily for weeks or even months is valuable for any form of chronic colitis.

Its nastiness is the only objection to it. As already mentioned, this can largely be overcome by holding the nose, and there are many forms of castor oil in the market so prepared as to be almost colourless and odourless. It may be taken in capsules, but they are bulky. The pharmacopœial mixture is not to be recommended. Lemon juice or coffee conceals the taste to some extent, or the oil may be added to a teaspoonful of peppermint water, and then a little brandy added till the oil neither sinks nor swims. If the inside and rim of the glass are moistened with the vehicle, the oil, which should, if possible, be between two layers of the vehicle, is hardly tasted.

As an enema (castor oil 1 fl. oz. (30 mils), warm olive oil 5 fl. oz. (150 mils), mix thoroughly) it is often very useful when a mild injection is required.

Breasts.—The leaves of the castor-oil plant applied to the breasts will sometimes induce th secretion of milk. A fluid extract of them may als be taken three or four times a day.

Castor-oil seeds are many times more purgative than th oil, because they contain a toxalbumin, ricin, which, whe injected into the blood, is one of the most powerful vegetab poisons known. It is much less active when swallowed, a it is largely destroyed by digestive ferments. After death th mucous membrane of the intestine is violently inflamed, the are ecchymoses all over the body, and blood in the serou cavities. Ehrlich, by gradually increasing the dose of rici was able to render animals immune to it, and this was show to be due to the formation in their body of antiricin, whic neutralized the action of the ricin. This discovery was th basis of our knowledge of serum therapeutics.

RHUBARB.

Rhei Rhizoma. Rhubarb Root. This was calle Rhei Radix B. P. 1898. The rhizome partly deprived of i bark and dried, of *Rheum officinale* and other species *Rheum*. China and Tibet.

Characters.—Cylindrical, conical, plano-convex, or irregular pieces. Outer surface sometimes covered with a brigh yellowish powder; rounded or angular, smooth or a littl wrinkled, showing beneath the powder reddish-brown line mixed with a yellowish-brown substance, and usually sma star-shaped spots. The pieces are often bored with a hol which may contain the remains of the cord used to suspen them to dry. Internally hard, compact, fracture uneven, an with a marbled appearance. Odour peculiar, aromati Taste feebly astringent, bitter; there is gritty feeling betwee the teeth when chewed.

Composition.—The chief constituents are—(1) *Chry arobin* (*synonyms*, rhein, chrysophan, *see* Chrysarobinum (2) *Chrysophanic acid* or *dioxymethylanthraquinone*. It is no known whether, when alive, rhubarb contains any chrysophanic acid for when kept the chrysarobin quickly oxidize to chrysophanic acid. The chrysarobin gives the yello colour. (3) *Emodin* or *trioxymethylanthraquinone*. (4) *Rheotannic acid*, to which the astringency of rhubarb is due (5) *Oxalate of lime*, 35 per cent., to which the grittiness i due. (6) Other bodies, about which little or nothing i known.

Impurities.—English rhubarb; different taste, smell, and excess of starch. Turmeric, which is turned brown by boric acid.

Dose, 3 to 10 gr.—2 to 6 decigrms. (repeated administration). **15 to 30 gr.—1 to 2 grms.** (single administration).

Preparations.

1. **Extractum Rhei.**—Alcoholic.
Dose, 2 to 8 gr. 12 to 50 centigrms.

2. **Infusum Rhei.**—1 in 20 of boiling water.
Dose, ½ to 1 fl. oz.—15 to 30 mils.

3. **Pilula Rhei Composita.**—Rhubarb, 25; aloes, 20; myrrh, 14; hard soap, 14; oil of peppermint, 2; syrup of glucose, 25.
Dose, 4 to 8 gr. 25 to 50 centigrms.

4. **Pulvis Rhei Compositus.** *Synonym.* Gregory's powder. Rhubarb, 22; light magnesia, 66; ginger, 12.
Dose, 10 to 60 gr.—6 to 40 decigrms.

5. **Syrupus Rhei.** Rhubarb, 70; oil of coriander, 0·5; sugar, 840; alcohol (90 per cent.), 280; water, to 1000.
Dose, ½ to 2 fl. dr.—2 to 8 mils.

6. **Tinctura Rhei Composita.** Rhubarb, 100; cardamoms, 12·5; coriander, 12·5; glycerin, 100; alcohol (45 per cent.) to produce 1000. Percolate.
Dose, ½ to 1 fl. dr. 2 to 4 mils (repeated administration); **2 to 4 fl. dr. 8 to 16 mils** (single administration).

ACTION.

External.—Probably rhubarb would have, to a mild degree, the same action as Goa powder, but it is never applied externally.

Internal.—*Alimentary canal.*—In the mouth, rhubarb increases the flow of saliva; and in the stomach, in small doses, it, like any other bitter substance, stimulates the flow of gastric juice, and the vascularity and peristaltic movements of the stomach. It is, therefore, a stomachic, and will aid digestion. In large doses it causes **purgation**, pr ducing in from four to eight hours a liquid motic coloured yellow by the chrysophan. Purgation due to the chrysophanic acid and emodin, bo anthraquinone derivatives, and it has been alrea pointed out that most vegetable purgatives owe th properties to derivatives of this body (see p. 95). T **resinous constituents of rhubarb are said to increa** the flow of bile, but certainly its cholagogue actic is not sufficiently powerful to explain its purg **tive properties. It is commonly stated to exa** gerate very actively intestinal peristalsis, but the is no adequate proof of this. It is liable to grip The purgation is followed by constipation; this ascribed to the rheo-tannic acid; if so, it is probab absorbed and subsequently re-excreted into the i testine, otherwise it would all be swept away in t purging.

Kidneys.—The colouring matter is excreted the urine, and stains it yellow when acid, red whe alkaline. The urinary flow is slightly increased.

THERAPEUTICS.

Rhubarb is commonly given to children as stomachic purgative in indigestion, especially whe caused by errors of diet, for it clears away any un digested food, and its stomachic and after-astringen effects are valuable. In the same way it is useful i diarrhœa due to irritation caused by undigeste food; here the after-astringency is especially se viceable. A powder of powdered rhubarb and sodiu bicarbonate (which hides the taste) equal part with some powdered gentian, or a similar fluid med cine, forms an excellent stomachic for young children Rhubarb should never be given alone, because of th **griping it causes.**

Purgatin.—(Not official.)
This is the usual name for Anthrapurpurin diacetate.
Dose, 15 to 30 gr.—1 to 2 grms.

Purgatin is of great interest, for it is a derivative of anthraquinone, and it was the first made synthetic purgative. It may cause colic and irritate the kidneys, but a great practical objection to its use is that it colours the urine a bright red. (For purgen, *see* p. 340.)

SENNA.

Sennæ Folia. Senna Leaves. The dried leaflets of *Cassia acutifolia* and of *Cassia angustifolia*, known in commerce as Alexandrian Senna and Tinnevelly Senna.

CHARACTERS.—Pale greyish or yellowish green, thin, brittle, 2 to 4 cm. long. Lanceolate or oval-lanceolate, acute, entire, unequal at base. Finely pubescent. Veined on the lower surface. Alexandrian is smaller than Tinnevelly.

COMPOSITION.—The chief constituents are (1) *Cathartic Acid*, an amorphous sulphurated glucoside, $C_{180}H_{192}N_4SO_{82}$. It exists as salts of earthy bases, such as calcium and magnesium. These salts are soluble in water. Cathartic acid is capable of decomposition into glucose and cathartogenic acid. It is the chief purgative principle in senna and other purgatives. (2) Other glucosides, sennacrol and sennapicrin, which do not in most preparations contribute to their action, as they are insoluble in water. (3) Chrysophanic acid, or dioxymethylanthraquinone, in small amounts (*see* Rhubarb and Chrysarobinum). (4) Emodin, or trioxymethylanthraquinone. (5) A sugar, catharto mannite. *Resembling Senna.* Leaves of *Solenostemma Argel*, Uva Ursi, and Barosma, all equal at the base.

IMPURITIES.—Any of the above.

Preparations.

1. **Confectio Sennæ.** Senna, 100; coriander fruit, 40; figs, 160; tamarind, 120; cassia pulp, 120; prunes, 80; extract of liquorice, 15; sugar, 400; water to make 1000.

Dose, 60 to 120 gr.—4 to 8 grms.

2. **Infusum Sennæ.**—Senna, 100; ginger, 5; boiling water, 1000.

Dose, ½ to 1 fl. oz.—15 to 30 mils—or as single draught, 2 fl. oz.—60 mils.

3. Mistura Sennæ Composita. *Synonym.*— Black draught. Magnesium sulphate, 25; liqui extract of liquorice, 5; aromatic spirit of ammoni 5; compound tincture of cardamoms, 10; infusion o senna, q.s. to make 100

Dose, 1 to 2 fl. oz. – 30 to 60 mils.

4. Pulvis Glycyrrhizæ Compositus. Senna i the most important constituent, 16 per cent. (*see* p. 612)

Dose, 60 to 120 gr. – 4 to 8 grm.

5. Syrupus Sennæ.—Senna, 440; oil of coriander, 0·2; sugar, 540; alcohol (90 per cent.), 2·0 alcohol (20 per cent.), 760.

Dose, ½ to 2 fl. dr. – 2 to 8 mils.

6. Tinctura Sennæ Composita. Senna, 200 caraway, 25; coriander, 25; glycerin, 100; alcohol (4 per cent.), to produce 1000. Macerate

Dose, ½ to 1 fl. dr. – 2 to 4 mils for repeate administration; **2 to 4 fl. dr. – 8 to 16 mils** fo single administration.

Sennæ Fructus. Senna pods. The dried rip fruits of *Cassia acutifolia* and *Cassia angustifolia.*

Characters.—Five centimetres long, and from two to two and a half wide; broadly oblong or somewhat reniform; pale green; brownish in the centre above the seeds; very flat, rounded at the base. Pericarp papery. Seeds obovate cuneate, flattened. Odour and taste slight. (For dose, *see* p. 505.)

Action.

External.—None.

Internal.—Senna, because of the cathartic acid in it, stimulates the muscular coat of the intestine, especially the colon, and produces some hyperæmia. Consequently the fluid contents of the small intestine are hurried through the colon, and pale yellow watery stools, containing some undigested food, are the result. Senna acts very feebly or not at all on the biliary secretion. Large doses open the bowels several times and produce **griping**, but not much hyperæmia. Probably there are other substances in senna besides cathartic acid having a purgative property, but it is by far the most important. Purgation by senna does not cause subsequent constipation. Some constituents of it are absorbed, and may cause the urine to be red. It will purge if injected into the veins, and ~~will~~ impart its purgative properties to the milk of nursing women.

THERAPEUTICS.

Senna is a safe, useful purgative for cases of simple constipation. The leaves, because of their tendency to gripe and nauseous taste, are rarely given alone. The compound liquorice powder is to be preferred to the Mistura Sennæ ("black draught"), as this is a nasty mixture. Senna is largely used to complete the effect of duodenal purgatives, as we see in the old prescription of a blue pill at night and a black draught in the morning. Acting on the colon, it is valuable in slight cases of fæcal collection. Compound liquorice powder is much used in habitual constipation and the constipation of pregnancy. Confection of senna, coated with chocolate, forms the well-known purgative Tamar Indien, and in this form can be taken by children. It is said that the infusion contains more of the active principles than other preparations; it soon decomposes, but 1 gr. of nitre to the fl. oz. will prevent this. Some preparations of figs have senna for their active ingredient.

An infusion of senna pods is a very popular aperient, and may be taken for a long while without any harm. It is pleasant and does not gripe, and is especially useful for children. Extractum Sennæ Liquidum B. P. C. (dose, ½ to 1 fl. dr., 2 to 4 mils) is an excellent preparation of the pods. Many patients infuse the pods themselves. For an adult six may may be allowed to stand in cold water for six hours

and the infusion drunk the last thing at nigh
Sometimes more than six, even up to twelve, a
required at first, but the dose can always be reduce
by gradually using fewer pods to make the infusio

CASCARA SAGRADA.

Cascara Sagrada. *Synonym*. Sacred Bar
Rhamni Purshiani Cortex. The dried bark of *Rhamn*
purshianus, California buckthorn, collected at least one ye
before being used.

CHARACTERS. Quills or nearly flat pieces. Smoot
purplish-brown cork almost covered with lichens; inne
surface brown, nearly smooth, and striated longitudinall
Fracture short externally, fibrous internally. Characterist
odour. Bitter taste.

COMPOSITION.—The chief constituents are Emodin, als
contained in rhubarb and senna (*q.v.*), Cascarin, Purshianin
a glucoside, several resins, various acids, and a volatile oil.

Preparations.

1. **Extractum Cascaræ Sagradæ Siccum.**—
Made by percolation with water and subsequent
evaporation.

Dose, 2 to 8 gr.—12 to 50 centigrms.

This was Extractum Cascaræ Sagradæ B. P. 1898

2. **Extractum Cascaræ Sagradæ Liquidum.**
—Made with alcohol (90 per cent.) and water.

Dose, $\frac{1}{2}$ to 1 fl. dr.—2 to 4 mils.

3. **Syrupus Cascaræ Aromaticus.** — Liquid
extract, 8; tincture of orange, 2; alcohol (90 per cent.),
1; cinnamon water, 3; syrup, to make 20.

Dose, $\frac{1}{2}$ to 2 fl. dr.—2 to 8 mils.

ACTION AND THERAPEUTICS.

Cascara sagrada is a **simple laxative** and aperient, not causing much griping, and resembling in its action frangula bark, which is no longer official and is now rarely used, but was thought to be more certain and more active. The bitter principle gives it stomachic properties. It is very serviceable for constipation, especially if chronic. Either a single pharmacopœial dose may be taken in the evening, or 10 to 15 ♏ (6 to 10 decimils) of the liquid extract may be given three times a day before meals. One advantage of its use is that gradually increasing doses are not required. The liquid extract is very bitter ; this taste may be concealed by aromatics, liquorice, or sal volatile, and it may be given in chloroform water. The aromatic syrup conceals the bitter taste very well, and a preparation known as Tinctura Laxativa (B. P. C.), dose 20 to 60 ♏ (12 to 36 decimils) (Extractum Cascaræ Sagradæ Liquidum 2, Spiritus Ammoniæ Aromaticus 2, Spiritus Chloroformi 2, Tinctura Belladonnæ 1, Tinctura Nucis Vomicæ 1), is miscible with water, and is a pleasant simple purge which is especially useful for chronic constipation, and may cure it. Cascara Jelly, dose 1 to 4 fl. dr. (4 to 16 mils), made with agar-agar jelly, makes the fæces bulky and moist.

ALOES.

Aloe.—The juice that flows from the transversely cut leaves of *Aloe chinensis*, *Aloe Perryi*, and probably other species, evaporated to dryness. Known as Curaçao aloes, Socotrine aloes, or Zanzibar aloes.

CHARACTERS. In hard masses varying from yellowish brown to dark or chocolate brown. Fracture dull, waxy, and uniform (Curaçao and Zanzibar aloes) or uneven and porous (Socotrine aloes). Small splinters show microscopic crystals imbedded in transparent mass. Characteristic odour ; taste nauseous and bitter. *Solubility.*—Almost entirely in alcohol (60 per cent.). *Resembling aloes.*—Resins of guaiacum and jalap, which are not bitter.

COMPOSITION.—The chief constituents are—(1) *Aloin* (see p. 508). (2) Emodin, or trioxymethylanthraquinone (see Senna). (3) A resin. (4) A trace of gallic acid. (5) A trace of a volatile oil giving the odour.

Dose, 2 to 5 gr.—12 to 30 centigrms.

Preparations.

1. **Extractum Aloes.**—Aqueous, 1 in 10.

Dose, 1 to 4 gr. 6 to 25 centigrms.

This was Extractum Aloes Barbadensis B. P. 18

2. **Decoctum Aloes Compositum.** Extract aloes, 2; myrrh, 1; potassium carbonate, 1; extra of liquorice, 8; compound tincture of cardamoms, 6 water, up to 200. Contains of the extract, 1 per cen *i.e.* 4½ gr. in 1 fl. oz.

Dose, ½ to 2 fl. oz.—15 to 60 mils.

3. **Pilula Aloes.** Aloes, 58; hard soap, 29; of caraway, 3; syrup of glucose, 10.

Dose, 4 to 8 gr.—25 to 50 centigrms.

4. **Pilula Aloes et Asafetidæ.**—Aloes, asafetid hard soap, of each 3; syrup of glucose, 1.

Dose, 4 to 8 gr. 25 to 50 centigrms.

5. **Pilula Aloes et Ferri.** Aloes, 2; exsiccate ferrous sulphate, 1; compound powder of cinnamo 3½; syrup of glucose, 3½.

Dose, 4 to 8 gr.—25 to 50 centigrms.

6. **Pilula Aloes et Myrrhæ.**—Aloes, 4 myrrh, 22; syrup of glucose, 34.

Dose, 4 to 8 gr.—25 to 50 centigrms.

Aloes is contained in: Pilula Colocynthidis Composit (1 in 3), and Pilula Colocynthidis et Hyoscyami (1 in 4½ Pilula Rhei Composita (1 in 6), Tinctura Benzoini Composit (1 in 60).

Extract of aloes is contained in Extractum Colocynthidi Compositum (1 in 2¼).

Aloin. A crystalline principle obtained from aloes.

CHARACTERS.—A pale yellow microcrystalline powder almost inodorous; taste intensely bitter, but tasting of aloes *Solubility.*—Freely in hot fluids, sparingly in cold water or cold alcohol, not at all in ether. Rapidly altered by alkalies. Aloin is the active principle of aloes, but it does not gripe so much.

Dose, ½ to 2 gr.—3 to 12 centigrms.

ACTION.

External.—Aloes has no external action on the unbroken skin, but it can be absorbed from a raw surface, for aloes sprinkled on an ulcer, to which it is a slight stimulant, will lead to purging.

Internal.—*Gastro-intestinal tract.*—In the stomach the bitter principle of aloes causes it to act as a **stomachic**, like other bitters. In the intestine it **increases** the rate of the flow of **bile**, and probably the amount secreted. It produces little influence in the small intestine, but the muscular coat of the **colon** is powerfully **stimulated**, and the intestinal secretion from that part slightly accelerated. Aloes, therefore, purges, and naturally takes some time, usually fifteen to twenty hours, to act; the motion is well formed, not very soft, as there is so little increased secretion of fluid, and it is dark coloured from the bile in it. Sometimes the drug gripes somewhat, because the muscular contraction it produces is irregular. As it acts chiefly on the lower bowel the habitual use of it may lead to piles.

Female genital organs.—Aloes will increase the menstrual flow; it is therefore an **emmenagogue.** It is excreted by the milk, for aloes given to the mother may purge the child. It is stated also to be excreted in the urine.

Barbados aloes is slightly more purgative than Socotrine aloes, and contains a greater proportion of substances soluble in water.

As a rule aloin acts like aloes, but it does not gripe so much. Some specimens, however, have very little action. This may be owing to adulteration, or differences in the composition of different specimens.

THERAPEUTICS.

Aloes is an excellent purgative for cases of habitual constipation, many of which are due to an imperfect contraction of the muscular coat of the large intestine. It is very commonly given as a

dinner pill (1 gr., 6 centigrms., of extract of aloe
½ gr., 30 milligrms., of aloin and ¼ gr., 16 milligr
of extract of nux vomica) to sufferers from chr
constipation, and in these cases its bitter princi
acting as stomachics aid digestion. If the faeces
hard ½ gr. (30 milligrms.) of powdered ipecacua
should be added. To avoid griping it is well to comb
a little extract of hyoscyamus or a little extrac
belladonna with it. One great advantage of aloe
that the dose need not be gradually increased. I
also very commonly given as a pill with nux vom
and a grain or two of the dried sulphate of iron
persons suffering from chlorosis and other forms
anæmia. It overcomes the chronic constipation
common in these cases, and some regard this as v
important for the cure of the disease. The amen
rhœa so frequently associated with chlorosis is of
benefited by aloes, and amenorrhœa due to ot
causes may also be relieved. Aloes is of gr
service in many cases of chronic constipation of ch
dren. A warm aqueous solution of aloin purg
when injected subcutaneously.

Aloes must not be given in pregnancy, hæm
rhoids, or menorrhagia. An enema of it is anth
mintic.

Class III.—**Drastic Purgatives**.

SCAMMONY.

Scammoniæ Radix.—Scammony Root. T
dried root of *Convolvulus scammonia*. Syria and Asia Min

Characters.—Cylindrical, except at upper end, where
is enlarged, and has remains of aerial stems; shrivelle
contorted, longitudinally furrowed. Externally, greyish bro
or yellow. Internally, pale grey or white. Fractured surfa
very coarsely fibrous. Odour and taste like jalap, fai
Resembling scammony root.—Belladonna, which is smaller.

Ipomœæ Radix.—*Synonyms.*—Orizaba Jalap Root, Mexican Scammony Root.

Source.—This is the dried root of Ipomœa Orizabensis.

Characters.—Irregular, tough fibrous pieces, often in portions of transverse slices of large roots. Externally greyish black, wrinkled. Internally grey or brown. Yields to alcohol a resin which has the properties enumerated under Scammony Resin.

Scammoniæ Resina.—Resin of Scammony. A mixture of resins obtained from scammony root or from Orizaba Jalap root.

Source.—Either root is exhausted with alcohol and the resin is precipitated with water and dried.

Characters.—Brownish, brittle, translucent pieces; fracture resinous. Odour fragrant. Soluble in ether. Tincture of it does not blue the fresh-cut surface of potato.

Composition.—The chief constituent is jalapin (*see* p. 513).

Impurities.—Guaiacum resin, which blues potato. Jalap resin insoluble in ether.

Dose, 4 to 8 gr.—25 to 50 centigrms.

Preparation.

Pulvis Scammoniæ Compositus.—Scammony resin, 50; jalap, 35; ginger, 15.

Dose, 10 to 20 gr. 6 to 12 decigrms.

Scammony resin also contained in Extractum Colocynthidis Compositum, Pilula Colocynthidis Composita, Pilula Colocynthidis et Hyoscyami.

ACTION.

Gastro-intestinal tract.—Scammony has no effect till it reaches the duodenum. With the bile it forms a **strongly purgative** compound, powerfully stimulating the intestinal glands and causing a profuse secretion of intestinal fluids. There is some exaggeration of vascularity, some irregular stimulation of the muscular coat, but these are comparatively slight, and there is little if any addition to the biliary flow.

As a result of these actions, in about four hou there is a profuse **watery evacuation** of the bowel The drug is, therefore, a powerful **hydragogu cathartic**, and in large doses a strong gastro-inte tinal irritant. Its action is attended with som griping. It produces no effect if injected into th blood, and therefore acts only locally on the intes tine. It is anthelmintic to both roundworms an tapeworms.

THERAPEUTICS.

Scammony being a prompt purgative, obstinat constipation, in either children or adults, may b treated with it. It may also be given as an anthel mintic.

JALAP.

Jalapa.—Jalap. The dried tubercles of *Ipomœa purga*

CHARACTERS.—Irregularly ovoid or oblong, hard, compact roots. Size variable, generally somewhere between a walnut and hen's egg. May be in halves and quarters. Externally dark brown, furrowed, wrinkled with pale lines or scars. Internally dirty yellow or brown, with dark brown irregular circles. Odour smoky, slight. Taste sweetish, acrid, nauseous.

COMPOSITION.—The chief constituent is the official *resin*. The Pharmacopœia directs that jalap should contain from 9 to 11 per cent. of the resin.

Dose, 5 to 20 gr.—3 to 12 decigrms.

Preparations.

1. Pulvis Jalapæ Compositus.—Jalap, 3 acid tartrate of potassium, 6; ginger 1.

Dose, 10 to 60 gr.—6 to 40 decigrms.

2. Tinctura Jalapæ.—Jalap and alcohol (70 per cent.). Percolate. *Standardized to contain between 1·45 and 1·55 per cent. of jalap resin.*

Dose, ½ to 1 fl. dr.—2 to 4 mils.

3. Tinctura Jalapæ Composita. Jalap, 80; scammony resin, 15; turpeth, 10; alcohol (60 per cent.), to produce 1000.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

Jalap is contained in Pulvis Scammonii Compositus, 3 in 8.

Jalapæ Resina.—Jalap Resin is a mixture of resins obtained from Jalap.

SOURCE. Jalap is digested and percolated with alcohol 90 per cent.). From the tincture thus formed the resin is precipitated with water. It is washed and dried.

CHARACTERS. Dark brown, opaque, brittle fragments, translucent at the edges, breaking with a resinous fracture. Odour sweetish. Taste acrid. *Solubility.*—Readily in alcohol 90 per cent.), not in water. *Resembling jalap.* Aloes, which is bitter.

COMPOSITION. The chief constituents are—(1) *Convolvulin*, a glucoside, a hard substance insoluble in ether, more active than jalapin, and the most abundant active ingredient of jalap. (2) *Jalapin*, a glucoside. Dose, ½ gr. This is a soft resinous substance, soluble in ether. The tubercles of *Ipomœa purga* contain very little, but scammony and other species of Ipomœa contain a considerable amount.

Dose, 2 to 5 gr. 12 to 30 centigrms.

ACTION.

The mode of action of jalap is precisely the same as that of scammony, with only two exceptions. It causes a greater secretion of intestinal juice, and is therefore more hydragogue; it stimulates the vessels and muscular coat less, and therefore is less irritant and griping.

THERAPEUTICS.

Jalap is very largely used as a hydragogue purgative when we want to draw off large quantities of fluid, therefore it is especially suitable for patients with Bright's disease, for those suffering from uræmia, and for those with dropsy from any cause.

Large doses should not be given if the intes
mucous membrane is liable to inflame easily.
occasionally employed for severe constipation.

KALADANA

Kaladana. *Synonym.* Pharbitis Seeds. The seeds of *Ipomœa hederacea.*

CHARACTERS. The seeds are in the form of a segment phere, about 5 millimetres long and wide. Black, ev at the hilum, where they are brown and hairy.

Dose. 30 to 45 gr. 2 to 3 grms. in powder.

Preparations.

1. **Pulvis Kaladanæ Compositus.** Kaladi 6; acid potassium tartrate, 6; ginger, 1.

Dose, 10 to 60 gr. 6 to 40 decigrms.

2. **Tinctura Kaladanæ.**—1 in 5 of alc (70 per cent.).

Dose, ½ to 1 fl. dr.– 2 to 4 mils.

Kaladanæ Resina. Kaladana Resin. *Synonym* Pharbitisin. Is a mixture of resins obtained from Kaland

SOURCE. Exhaust Kaladana with alcohol, precipitate resin with water and dry.

CHARACTERS. Brownish opaque fragments, translucen edges, breaking with a resinous fracture. Insoluble in wa easily soluble in alcohol (90 per cent.).

Dose, 2 to 8 gr.– 12 to 50 centigrms.

ACTION AND THERAPEUTICS.

Kaladana resin resembles the convolvulin fou in jalap, and kaladana and its resin have the san actions and may be used for the same purposes jalap. They are used principally in India and t East Indies.

TURPETH.

Turpethum. -The dried root and stem of *Ipomo turpethum.*

CHARACTERS.—As found in commerce consists of the ro and stem cut into short lengths 1 to 5 centimetres in diamete often split on one side with the central woody portion removed. The exterior surface furrowed and dull grey.

Dose, 5 to 20 gr.—3 to 12 decigrms. in powder.

Preparation.

Tinctura Jalapæ Composita. Jalap, 80; scammony, 15; turpeth, 10; alcohol (60 per cent.), to produce 1000.

Dose, ½ to 1 fl. dr. 2 to 4 mils.

ACTION AND THERAPEUTICS.

The drug is active because of the resin it contains, usually about 10 per cent. This is a glucoside with the same chemical and physiological properties as convolvulin, the active glucoside of jalap. Therefore the actions and uses of turpeth are the same as those of jalap. It is used chiefly in India, the East Indies, and North America.

CROTON OIL.

Oleum Crotonis. The fixed oil expressed from seeds of *Croton tiglium*. East Indies.

CHARACTERS.—Brownish yellow to dark reddish brown. sp. gr. 0·94 to 0·96. Odour faint, peculiar, rancid. Taste ly, acrid. *Solubility.* Freely in alcohol, ether, chloroform, olive oil.

COMPOSITION.—The chief constituents are—(1) Several atile acids (1 per cent. in all); these give the odour. 2 Tiglic or methyl crotonic acid, $C_5H_8O_2$. (3) Glyceryl of tonoleic acid, $C_9H_{14}O_2$. This appears to be the active principle. (4) Several fatty acids, both free and combined to m fats. (5) Crotonol, a substance which is non-purgative, it is capable of causing some cutaneous irritation.

Dose, ½ to 1 m. 3 to 6 centimils on a lump of ar, or mixed with butter or vaseline and placed at the back the mouth, so that it may be quickly swallowed.

Preparation.

Linimentum Crotonis.—Croton oil, 12; oil of cajuput, 44; alcohol (90 per cent.), 44.

(Croton seeds are not official, but it is important to recog ze them. They are ½ in. long, ⅓ in. broad, ovoid and bluntly oblong, covered with a brown shell, which on scraping bec black. The kernel is white and oily. They yield 50 to 6 cent. of croton oil. They are known from castor oil s which are like them, by the fact that the castor oil seed bright, polished, and mottled.)

ACTION.

External. Croton oil is one of the **most powe irritants** in the Pharmacopœia. A drop placed the skin causes redness, burning pain, and quic a crop of vesicles forms (vesication); these rap become **pustules** (pustulation), and the surround subcutaneous tissue is **red and œdematous.**

Internal. *Gastro-intestinal tract.* Very so after a drop has been taken there is considera griping and abdominal pain. In an hour or two bowels are opened, and this may subsequently oc several times, the motions becoming more and m fluid. The croton oil greatly aggravates the va cularity of the stomach and intestines, the muco membrane of which becomes red, œdematous, a angry looking; there is a great increase of the int tinal secretion, but none of the bile. The drug p duces, in fact, severe **enteritis**, and to a less extent ga tritis. The motions may contain blood. These effe are all due to the crotonoleic acid, which resembl the ricinoleic acid of castor oil, but is much mo powerful and is much more easily set free from crot oil, hence the external irritant action of the oil. It probable that the peristaltic movements are increas also. Croton oil applied to the skin may cause fr purgation, the acid being excreted into the bowel.

THERAPEUTICS.

External. Croton oil was formerly employe externally as an irritant and counter-irritant f inflamed joints, pleurisy, bronchitis, phthisis, &c. but it is not often so used now, as the scars left afte the suppuration are very unsightly, the application is too painful, and the inflammation induced too severe. A little croton oil spread over an area not exceeding that of a sixpence may be applied to set up suppuration in the scalp, and so to destroy an inveterate patch of ringworm, if it is wished to cure it quickly. The croton oil will certainly do this, but the resulting suppuration is so severe that the remedy should be used with care, and only when all others have failed. The liniment, well diluted, is occasionally employed to stimulate the skin in alopecia.

Internal.—Croton oil should only be given in very obstinate constipation not due to organic obstruction, and only one dose should be administered. Not more than one or two drops should be prescribed. Constipation due to lead poisoning and fæcal impaction are sometimes suitable cases. Placed on the back of the tongue, it is, on account of its small bulk a useful purgative for lunatics who refuse to take anything, and for unconscious patients, because in such cases it is swallowed reflexly and acts quickly, and therefore it is commonly given to those who are unconscious from apoplexy, but it must be diluted by mixture with sugar or butter to prevent local inflammation of the tongue. It should never be administered to children, to pregnant women, to feeble subjects, to those with hæmorrhoids, nor to those suffering from peritonitis, gastritis, or enteritis.

Croton-oil seeds contain a poisonous toxalbumin, crotin which resembles ricin (*see* p. 500).

COLOCYNTH PULP.

Colocynthidis Pulpa. The dried pulp of the fruit of *Citrullus colocynthis*, freed from seeds. *Synonym.*—Bitter calumba. Imported from Smyrna, Trieste, France, and Spain.

CHARACTERS. More or less broken, whitish, very light, spongy, tough balls, about 2 in. in diameter, consisting of the pulp in which the seeds are embedded. The broke pulp without the seeds is alone official. This is light, sp whitish, odourless, with an intensely bitter taste.

IMPURITIES. – Seeds and cortex.

COMPOSITION. The chief constituents are (1) C thin, an amorphous or crystalline, bitter, active gluco readily soluble in water and alcohol. (2) Resinous ma aving the names of citrullin, colocynthein, and colocynth insoluble in water.

Preparations.

1. Extractum Colocynthidis Compositum Colocynth pulp, 150; extract of aloes, 300; re of scammony, 100; curd soap, 75; cardamoms, alcohol (60 per cent.), 4000.

Dose, 2 to 8 gr. 12 to 50 centigrms.

2. Pilula Colocynthidis Composita. C cynth pulp, 20; aloes, 35; resin of scammony, potassium sulphate, 5; oil of cloves, 5; water, q.s.

Dose, 4 to 8 gr. 25 to 50 centigrms.

3. Pilula Colocynthidis et Hyoscyami Pilula colocynthidis composita, 2; extract of hyosc mus, 1; water, q.s.

Dose, 4 to 8 gr. 25 to 50 centigrms.

ACTION.

In small doses colocynth acts as a simple **bitte** increasing the gastric and intestinal secretions a improving the appetite. In larger doses it augmen the flow of bile and succus entericus considerab stimulates the muscular coat, causes a little gripin and leads to the evacuation of a **watery motion.** still larger doses the hypersecretion is excessive a the griping is severe because the muscular coat powerfully irritated, and several abundant wate motions result. The drug may therefore be call **drastic, hydragogue, and cathartic.** The depressi produced may be considerable.

THERAPEUTICS.

Colocynth should never be given alone, because of the griping it causes. In the colocynth and hyoscyamus pill, which is often prescribed, the hyoscyamus prevents this painful result. Colocynth is an excellent purgative for producing a single abundant evacuation of the bowels in chronic constipation, such as that so often met with in persons suffering from hepatic disorder, and in those confined to bed. Because of the watery character of the motions it may be given in ascites or Bright's disease, but jalap or scammony is usually preferred. It is too irritant for habitual use. It should never be administered if there is any suspicion of intestinal or gastric inflammation, nor in pregnancy. It is often combined with milder purgatives. A diuretic action has been claimed for it, but this is unimportant.

CLASS IV.—**Cholagogues.**

PODOPHYLLUM.

Podophylli Rhizoma.—Podophyllum Rhizome. The dried rhizome and roots of *Podophyllum peltatum*, the American May-apple. Imported from North America.

CHARACTERS.—Pieces of variable length and about 5 millimetres thick, cylindrical, with at intervals of 5 centimetres tuberosities, which are marked above by a depressed circular scar and give off below a number of very brittle brownish rootlets, or show, if these are broken off, a corresponding number of whitish scars; externally dark reddish brown, smooth or wrinkled; fracture short; internally whitish and mealy or yellowish brown and horny. Odour faintly narcotic. Taste bitterish, acid, nauseous.

COMPOSITION.—The chief constituents are—(1) The alkaloid *berberine*. (2) The official *resin*, which is the purgative principle.

Podophylli Resina.—Podophyllum Resin.

Synonym.—Podophyllin

SOURCE. Extract the root by percolation with alcohol

(90 per cent.), and precipitate the resin with water acidulated with hydrochloric acid. Wash and dry.

CHARACTERS.—A pale yellow to deep orange-brown amorphous powder, soluble in alcohol and ammonia.

COMPOSITION.—Podophyllum resin contains at least two other resins, one soluble and the other insoluble in ether. These resins contain an active purgative crystalline body, podophyllotoxin. This, it is said, can be split up into picro podophyllic acid, which is inert, and picro podophyllin, a crystalline neutral body, the active principle. Both these also exist free in the rhizome.

INCOMPATIBLES. Water precipitates it from alcohol, acids precipitate it from ammonia.

Dose, $\frac{1}{4}$ to 1 gr.—16 to 60 milligrms.

Preparation.

Tinctura Podophylli.—Resin of podophyllum, 36·5; alcohol (90 per cent.), 1000. Macerate.

Dose, 5 to 15 m.—3 to 10 decimils.

ACTION.

External.—It has no external action unless applied to raw surfaces, from which it may be absorbed and then it will purge.

Internal.—*Gastro-intestinal tract.* Podophyllum has a bitter taste. It is in large doses a powerful gastro-intestinal irritant, and has caused death. In medicinal doses it gives rise to much griping pain, perhaps some nausea, and in about ten hours there is an **evacuation of the bowels**; the motion, which is liquid, is deeply stained with bile. The pain shows that the muscular coat is stimulated, the liquidity that probably an excess of intestinal fluid is secreted, and the colour that the drug is an indirect cholagogue (p. 102). In small doses podophyllum is by some believed to increase the secretion of bile, and certainly the solids in it are greater; in purgative doses it is said not to increase the quantity, but that more bile is poured from the gall-bladder into the intestine. It probably acts after absorption.

for all its effects can be produced if it is injected subcutaneously.

THERAPEUTICS.

Podophyllum is only used for its cholagogue purgative action. It is especially suitable for constipation due to hepatic disorder, whether functional, as in the hepatic dyspepsia which commonly goes by the name of biliousness, or organic, as in hepatic cirrhosis and cancer. It must be remembered that, as it causes much griping, it should be combined with hyoscyamus or some other drug to overcome this; that it takes a long while to act, and will therefore be swept away before it has produced any effect if given with quickly acting purgatives; and that it is better to begin with small doses, as people are very unequally affected by it. It may be advantageously combined with calomel in a pill. It is so disagreeable to the taste that it is better to dissolve the resin in aromatic spirits of ammonia (1 gr. to 1 fl. dr., 6 centigrms. to 4 mils) than to use the pharmacopœial tincture, as water does not precipitate the resin from ammonia, but it does from the pharmacopœial tincture.

INDIAN PODOPHYLLUM.

Podophylli Indici Rhizoma. The dried rhizome and roots of *Podophyllum emodi.*

CHARACTERS.—Rhizome, more or less cylindrical and contorted, about 10 millimetres thick, crowned with remains of aerial stems bearing cup-shaped scars, below numerous root scars or stout roots. Faint odour, bitter taste.

Officially used in India and Eastern Colonies.

Podophylli Indici Resina. A powdered resin prepared from Indian *Podophyllum rhizome,* and resembling the other variety of *Podophyllum resin.*

Dose, ¼ to 1 gr.—16 to 60 milligrms.

Preparation.

Tinctura Podophylli Indici.—Indian pod
phyllum resin, 36·5; alcohol (90 per cent.), 1000.

Dose, 5 to 15 m. 3 to 10 decimils.

ACTION AND THERAPEUTICS.

Indian podophyllum has precisely the sam
actions and uses as the other variety.

EUONYMUS BARK.

Euonymi Cortex. Euonymus Bark. The drie
root bark of *Euonymus atropurpureus*. *Synonyms.* Wahoo
spindle-tree, hominy bush. United States.

CHARACTERS.—Incurved or quilled pieces, 2 to 4 milli
metres thick. Colour light ash-grey with darker patche
Inner surface tawny white and smooth, when freed fron
fragments of white wood. Taste at first sweet, then bitte
and acid.

COMPOSITION. The chief constituents are (1) *euonymi*
a resin, (2) asparagin, and (3) euonic acid.

Preparation.

Extractum Euonymi (commonly called euonymin).—Euonymus bark, in powder, is percolated wit
alcohol (45 per cent.); the liquid is evaporated till a brown dry powder is left, which is incorporated with a quarter of its weight of calcium phosphate, the object of which is to prevent it from agglutinating. It must be kept in a well stoppered bottle.

Dose, 1 to 2 gr. 6 to 12 centigrms.

This is Extractum Euonymi Siccum, B. P. 1898.

ACTION AND THERAPEUTICS.

In small doses euonymin stimulates the appetite and the flow of gastric juice. In larger it is irritant to the intestine and is cathartic. It is an indirect cholagogue (p. 102), but does not gripe or cause much intestinal secretion. Some state that it increases the solids of the bile. It has slight diuretic and expectorant effects, but its only use is as a purgative for those cases of constipation in which the liver is disordered, and for which it is particularly efficacious. It is usually combined in a pill with other cholagogues, as iridin and calomel.

Iridin.—(Not official.)

Synonym.—Irisin. This is the Extractum Iridis (B.P.C.). It is the powdered resin obtained by extraction from the root of *Iris versicolor*, the blue flag. Britain.

CHARACTERS.—A dark brown, bitter, nauseous powder.

Dose, 1 to 3 gr. 6 to 20 centigrms. in a pill with glycerin of tragacanth or extract of henbane.

ACTION AND THERAPEUTICS.

Iridin is a cholagogue, increasing chiefly the biliary solids, and as it rarely gripes it may be given when it is required to use a cholagogue purgative daily for some time. It may be combined with euonymin, calomel, podophyllin, and other cholagogue purgatives.

GROUP VI.

Volatile Oils.

These, when applied externally, stimulate the skin, and thus cause **redness**, sometimes even vesication, tingling, and subsequent numbness. Taken internally, they stimulate the gastro-intestinal tract, increasing its vascularity, the flow of saliva, of gastric juice, and of succus entericus; and they are commonly said to excite its unstriped muscular fibres, but there is evidence that they diminish griping by lessening and regulating muscular contraction. Thus in moderate doses they are **stomachics** and **carminatives**; in large doses they are gastro-intestinal **irritants**. Their irritation of the stomach reflexly stimulates the heart and the central nervous system. They are absorbed and excreted by the skin, which they may thus irritate, and by the bronchial mucous membrane, which they consequently stimulate, increasing the amount of secretion from it, its vascularity, the expulsive power of its unstriped muscle, and reflexly this irritation leads to coughing; c sequently they are **expectorants.** They are also lar excreted by the kidneys, which are stimulated even to infl mation, and hence these drugs are often **diuretic**; an the **genito-urinary mucous membrane**, which is stimulated, often so energetically that it becomes inflan Some volatile oils act strongly in all these ways; others much more powerfully in some than in others. They wil classified according to the tissue on which they chiefly or for the action for which they are mostly used.

Class I.—Volatile oils (or substances containing the acting chiefly upon, or used chiefly for their stimulation the **skin.**

Oil of Turpentine, Tar, Oil of Cade, Res Frankincense, Canada Balsam, Oil of Mustard, of Cajuput, Oil of Eucalyptus, Oil of Rosema Arnica Flowers, Oil of Lemon Grass.

Class II. Volatile oils (or substances containing the acting chiefly upon, or used chiefly for their stimulation of, t **gastro-intestinal tract.**

Pyrethrum, Cloves, Pepper, Nutmeg, Cinnamo Horseradish, Capsicum, Ginger, Cardamoms, Oil Lavender, Oil of Peppermint, Oil of Spearmint, Ani Coriander, Fennel, Caraway, Dill, Chamomile, Ros Betel.

Class III.—Volatile oils (or substances containing ther acting chiefly upon the stomach, so as to reflexly stimulate t **heart and central nervous systems**, or chiefly used f this purpose.

Valerian, Asafetida, Ammoniacum, Myrrh.

Class IV.—Volatile oils (or substances containing ther acting chiefly upon, or used chiefly for their stimulation o the **bronchial mucous membrane.**

Terebene, Balsam of Peru, Balsam of Tol Storax, Oleum Abietis.

Class V.—Volatile oils (or substances containing them acting chiefly upon, or used chiefly for their stimulation o the **kidneys and genito-urinary tract.**

Oil of Juniper, Buchu, Copaiba, Cubebs, Oil o Sandal-wood.

CLASS I. OF **Volatile Oils.**

Those used chiefly for their action on the skin.

OIL OF TURPENTINE.

Oleum Terebinthinæ Rectificatum. Rectified Oil of Turpentine. The oil distilled, from the oleo-resin (common turpentine) exuding from various species of *Pinus* and rectified.

CHARACTERS.—Limpid, colourless. Odour strong, peculiar. Taste pungent, bitter. Neutral. Mixes with other volatile and fixed oils. Dissolves resins (the solution forms varnish), wax, sulphur, phosphorus, and iodine. *Solubility.*—Not at all in water, 1 in 6½ of alcohol (90 per cent.), 3 in 10 of ether, and in all proportions in absolute alcohol, bisulphide of carbon, and chloroform. It is easily oxidized. Old oil of turpentine is an ozonizing agent; it readily absorbs oxygen, and becomes converted into an oleo-resin. French oil of turpentine is lævo-rotatory, some of it comes from *P. maritima*; English oil of turpentine, which mostly comes from America, and Russian oil of turpentine are dextro-rotatory.

COMPOSITION.—Oil of turpentine is a mixture of (1) several isomeric hydrocarbons (*terpenes*), all having the formula $C_{10}H_{16}$. The chief of them found in the oil are pinene, phellandrene, limonene, and dipentene. They vary in their boiling-points and the direction in which they rotate the plane of polarization. The principal terpene in American oil of turpentine is dextropinene; the principal terpene in French oil of turpentine is lævopinene. (2) Sesquiterpenes, $C_{15}H_{24}$. (3) Bornyl acetate. Most turpentine contains about 15 per cent. of oil of turpentine. Many official volatile oils, *e.g.* those of lavender, peppermint, chamomile, caraway, cloves, contain various terpenes, all isomeric, and all having the formula $C_{10}H_{16}$. An oxidation product of terpene is camphor, $C_{10}H_{16}O$, which is pharmacopœial (*see* p. 639). Sanitas (p. 528) is another product of the oxidation of a terpene.

Dose, 2 to 10 m. 12 to 60 centimils, or **3 to 4 fl. dr.—12 to 15 mils** (anthelmintic).

1 fl. dr. of mucilage with thorough trituration emulsifies 1 fl. dr. of oil of turpentine with 1 fl. oz. of water.

Preparations.

1. Linimentum Terebinthinæ. Oil of turpentine, 650; camphor, 50; soft soap, 75; water, to 1000.

2. Linimentum Terebinthinæ Aceticum. Glacial acetic acid, 110; liniment of camphor, 445 rectified oil of turpentine to produce 1000.

ACTION.

External.—Oil of turpentine has to a marked degree the action of other volatile oils. Thus, applied to the skin, especially if rubbed in, it causes the vessels to dilate, there is a sense of warmth, the part becomes red, and subsequently common sensation is blunted. This oil is therefore **rubefacient**, **irritant**, and **counter-irritant**. If enough is applied it is a vesicant. Like the other volatile oils it is **antiseptic** and **disinfectant**. It is absorbed by the unbroken skin.

Internal. *Alimentary canal.* Oil of turpentine has the same stimulant effect when locally applied to the mouth and pharynx as it has on the skin, and in the stomach it powerfully dilates the vessels, increases gastric secretion, co-ordinates peristalsis, lessens griping, and reflexly stimulates the heart, but on account of its nauseous taste it is not used for these properties, which it has in common with other volatile oils. Its effects on the intestine are the same as those on the stomach, hence it is a strong **carminative**, expelling gas from the bowels. A very large amount leads to **purging**, the motions sometimes containing blood, hæmorrhage resulting from the great vascular dilatation. Oil of turpentine is **anthelmintic**, killing the tapeworm when administered in doses of 2 to 4 fl. dr. (8 to 16 mils); but this treatment may cause severe symptoms. When given as an enema it kills the threadworm.

Circulation.—Oil of turpentine is readily absorbed. Formerly it was thought to stimulate the heart, but any action in this direction is very slight. It contracts the vessels, acting on the vaso-motor centre, and for this reason and because, locally applied to a bleeding vessel, it clots the blood, it is a **hæmostatic**. The blood-pressure rises. After a large dose of any variety this stimulation is followed by depression, the heart beats feebly, the vessels dilate, and blood-pressure falls.

Respiration.—When inhaled, oil of turpentine acts on the bronchial mucous membrane as it does on the skin, irritating it, dilating the vessels, increasing and disinfecting the secretion, stimulating the muscles of the bronchi, and reflexly exciting cough. If given internally, as some of it is excreted by the bronchial mucous membrane, similar effects are produced. At the same time the activity of the respiratory movements is increased from central stimulation, so that the drug is a **powerful expectorant.**

Nervous system.—Oil of turpentine in large doses is a severe depressant to the nervous system, producing languor, dulness, sleepiness, and unsteady gait. Toxic doses cause coma and paralyse the sensory nerves; consequently reflex action is abolished.

Kidneys.—It acts more powerfully on these than almost any other volatile oil. Even moderate doses may lead to pain in the loins, scanty high-coloured urine, albuminuria, and **hæmaturia.** The **urinary passages are** also **irritated**; consequently, owing to muscular spasm, there is difficulty in passing water, micturition is painful, and a sensation of heat in the perinæum is present (these symptoms constitute strangury). If a large dose has been given the urine may be completely suppressed. Turpentine causes the urine to smell of violets. Some of it is excreted unchanged, some in combination with glycuronic acid.

Skin.—Oil of turpentine is excreted by the skin, and may cause an erythematous rash.

Some is excreted by the respiratory mucous membrane, the milk, bile, and intestinal mucous membrane.

It is said to be a mild antipyretic. Oil of turpentine is an antidote to phosphorus, and it is stated that old oil of turpentine and French oil of turpe tine are preferable, but this is doubtful.

THERAPEUTICS.

External.- Oil of turpentine is very large employed as an irritant or counter-irritant in vario forms of chronic inflammation, such as oste arthritis, bronchitis, or pleurisy. The liniments for useful applications. They may also be rubbed over painful areas, as in neuralgia, myalgia, rhe matic pains, and lumbago. Sometimes it is used a parasiticide for ringworm. Sanitas is an aqueou solution of common turpentine, which has bee allowed to oxidize in the air. Its active antisept principle is peroxide of hydrogen (*see* p. 128), and contains a little thymol. It is a very pleasant dis infectant, but is not so strong as carbolic acid.

Internal. *Stomach and Intestines.* Oil of tur pentine is not often prescribed for its carminative an stomachic effects, though given either by the mout or as an enema (1 fl. oz., 30 mils, to 15 fl. oz., 45 mils, of mucilage of starch) it is often very efficaciou in removing the intestinal distension due to gas If it is used as an anthelmintic, 2 to 4 fl. dr. (8 t 16 mils) emulsified in mucilage and followed by dose of castor oil should be given. Sometimes i promptly relieves gastric or intestinal hæmorrhage such as that due to gastric ulcer or typhoid fever Whenever it is prescribed as a hæmostatic, consider able doses, 30 to 60 ♏ (2 to 4 mils) suspended in mucilage, should be administered every hour for a few hours.

Circulation.—It is not employed to influence thi except as a hæmostatic. It has had the reputation o being fairly efficacious in arresting hæmorrhage.

Respiration.— It is not much used as an inha ation, for the vapour of Oleum Abietis (*see* p. 570) is pleasanter; but it might be employed to disinfect foul bronchial secretions, and to stimulate the mucous membrane in chronic bronchitis.

It should be remembered that oil of turpentine must be given internally with great care because of its liability to cause inflammation of the kidneys; indeed, this fact and its nasty taste account for its not being so often administered as would otherwise be the case. It should never be given to the subjects of Bright's disease.

TAR.

Pix Liquida.—Wood Tar. A bituminous liquid obtained from the wood of *Pinus sylvestris*, and other species of *Pinus* by destructive distillation. Known in commerce as Stockholm tar.

Characters.—Brownish-black semi-liquid substance. Odour peculiar, aromatic. Water shaken with it acquires a pale brown colour, empyreumatic taste, and acid reaction. *Solubility.*—1 in 10 of alcohol (90 per cent.), slightly in oil of turpentine or olive oil, 1 in 3 of a solution of caustic soda. On distillation it gives off an empyreumatic oil (oil of tar), which is official in the United States, and pyroligneous acid. What remains behind is pitch. This is black, solid, melting in boiling water.

Composition.—Wood tar is a very complex substance. The chief constituents are (1) *Oil of turpentine* (*see* p. 525). (2) *Creosote* (*see* p. 342). (3) Phenols (*see* p. 335). (4) Pyrocatechin. (5) Acetic acid. (6) Acetone. (7) Xylol. (8) Toluol. (9) Methylic alcohol. (10) Resins.

Dose, 10 to 30 m.—6 to 18 decimils in the form of pills.

Preparation.

Unguentum Picis Liquidæ.—Wood tar, 70; prepared lard, 5; yellow beeswax, 25.

In India prepared suet should be used instead of prepared lard.

Pix Carbonis Præparata. Prepared coal tar.

Source.—Commercial coal tar is stirred and heated at 50°C. for 1 hour.

CHARACTERS. A nearly black, viscous liquid, brown very thin layers. Heavier than water. Strong characteristi odour. Soluble in benzene and chloroform, very slightly water.

COMPOSITION. It contains chiefly (1) Benzene an homologous hydrocarbons. (2) Phenols. (3) Solid hydrocarbons, as naphthalene and anthracene.

Preparation.

Liquor Picis Carbonis. Quillaia bark, 10, percolated with alcohol (90 per cent.), 100 To the percolate is added prepared coal tar, 20. When, in prescribing, water is added to this solution of tar the quillaia helps to suspend the precipitated ta

ACTION.

External.—Tar has precisely the same actions as oil of turpentine, but is not so powerful, therefore the vascular dilatation rarely proceeds to the stage of vesication; but pustules may result if the tar is rubbed in.

Internal. It is very liable to upset digestion; in large doses it causes epigastric pain, vomiting, severe headache, dark urine, and other symptoms of carbolic acid poisoning (*see* p. 340). Some of its constituents are excreted by mucous membranes, especially the bronchial, on which it acts as a disinfectant stimulating expectorant.

THERAPEUTICS.

External.—Tar ointment, which is rather hard, and may be softened by replacing half the wax with almond oil, is often applied as a stimulant to chronic skin diseases, such as psoriasis and chronic eczema. Because of its mildly local anæsthetic action, it is sometimes useful in pruritus.

Liquor Picis Carbonis is a favourite preparation for many skin diseases. It is an imitation of the popular Liquor Carbonis Detergens, which is an alcoholic solution of ordinary coal tar.

Internal. Coal tar is rarely prescribed for internal use. Wood tar is only given as an expectorant, and it is very valuable for chronic bronchitis. It may be prescribed as a pill, as perles, or as the Syrupus Picis Liquidæ (B. P. C., dose 1 to 2 fl. dr.—4 to 8 mils), or as Vinum Picis (a saturated solution of wood tar in sherry, dose 1 to 4 fl. dr.—4 to 16 mils), or as the French preparation eau de goudron. Tar water is made by stirring a pint of wood tar with half a gallon of water for fifteen minutes and decanting. The dose is a pint daily. It may be used externally as a wash. The Syrup of Liquid Tar with Syrup of Virginian Prune (*see* p. 473) and $\frac{1}{20}$ gr. (3 milligrms.) of Apomorphine hydrochloride forms an excellent cough mixture.

OIL OF CADE.

Oleum Cadinum.—*Synonyms*. Huile de cade, Juniper tar oil. An empyreumatic oily liquid obtained by the destructive distillation of the woody portions of *Juniperus Oxycedrus*.

CHARACTERS. An empyreumatic, dark reddish-brown, viscid, oily liquid. Odour smoky, tar like. Taste aromatic. Sp. gr. 0·99. *Solubility*.—Freely in ether and chloroform. Slightly in alcohol, not in water. Mixes readily with fats and fixed oils.

COMPOSITION. Probably similar to that of wood tar.

ACTION AND THERAPEUTICS.

Oil of cade has the same action on the skin as tar, but it is preferable, as the odour is pleasanter. The diseases treated by the application of it are psoriasis, chronic eczema, and pruritus. A usual formula is oil of cade 1, soft soap 4, alcohol (90 per cent.) 4, but an ointment (Unguentum Olei Cadini, B. P. C.) made by melting it with an equal part of yellow wax is a more agreeable preparation.

RESIN.

Resina. *Synonym.*—Rosin. The residue left afte distillation of oil of turpentine from the crude oleo-resi (crude turpentine) of various species of *Pinus*.

CHARACTERS. Translucent, yellowish, brittle, pulveriz able. Fracture shining. Odour and taste like turpentin Burns with a yellow flame and much smoke. Soluble i alcohol, ether, alkalies, and carbon bisulphide.

COMPOSITION. The chief constituent is abietic aci $C_{19}H_{29}\cdot COOH$, a crystalline substance.

Preparations.

1. Emplastrum Resinæ. *Synonym.* Adhesive plaster. Resin, 10; lead plaster, 85; hard soap, 5

2. Unguentum Resinæ. *Synonym.* Basilicon ointment. Resin, 26; yellow beeswax, 26; olive oil, 26 prepared lard, 22. In India prepared suet should b used instead of prepared lard.

Resin is contained in many plasters.

ACTION AND THERAPEUTICS.

Resin is antiseptic and slightly stimulant, and is, therefore, an excellent application for indolent ulcers, sores, and wounds.

CANADA BALSAM.

Terebinthina Canadensis. Canada Turpentine, or Canada Balsam. The oleo-resin obtained from *Abies balsamea*. Canada.

CHARACTERS. It is pale yellow, faintly greenish, transparent, fluid, of the consistency of thin honey. Odour peculiar, agreeable. Taste slightly bitter. It slowly dries, forming a transparent varnish. Readily soluble in ether, chloroform, or spirit.

COMPOSITION. It is an oleo-resin, and contains oils and resins isomeric with those of ordinary turpentine and resin.

Canada balsam is contained in Collodium Flexile.

ACTION AND THERAPEUTICS.

Canada balsam is rarely used except for its physical property [illegible] drying to form an adhesive varnish. It has the same action as oil of turpentine.

MUSTARD OIL.

Oleum Sinapis Volatile. The volatile oil distilled from black mustard seeds deprived of most of their fixed oil and macerated in water for several hours.

CHARACTERS. Pale yellow or colourless; intensely pungent and irritant. Sp. gr. 1·014 to 1·025. *Solubility.* 1 in 50 of water, readily in spirit and in ether.

COMPOSITION.—The Pharmacopœia directs that it contain not less than 92 per cent. of *Allyl isothiocyanate*, C_3H_5NCS.

Preparation.

Linimentum Sinapis. Volatile oil of mustard, 35; camphor, 55; castor oil, 125; alcohol (90 per cent.), to 1000.

ACTION.

External.—Mustard is a typical powerful local **irritant.** Thus [illegible] first produces dilatation of the vessels, which causes redness of the skin (**rubefacient** effect) and a sensation [illegible] warmth. Because [illegible] the irritant action of [illegible] on the sensory nerves, a severe **burning pain** is soon felt. This irritation of the nerves is followed by their paralysis, consequently there is a local **loss of sensibility**, and a diminution both of the pain produced by the mustard and of any that may have been present before its application. The irritation of the vessels leads to the transudation of plasma through them; this, collecting under the epidermis, raises it, and thus **vesicles**, blebs, or blisters are formed (vesicant effect). Mustard is also a **counter-irritant** (*see* p. 60): that is to say, the stimulation of the cutaneous nerves reflexly leads to an alteration in the size of the vessels of the viscera under the seat of application.

This excitation of the sensory nerves is sufficiently powerful to **reflexly stimulate the heart and respiration**, and sometimes to restore consciousness after fainting.

Internal. —*Gastro-intestinal tract.*— Mustard also acts here as an irritant. Taken in the usual small quantities as a condiment, it causes a sense of warmth in the stomach, it moderately **stimulates** the secretion of gastric juice, and therefore sharpens the appetite. A dose of one to four teaspoonfuls stirred up in a tumbler of water is sufficiently irritating to be a direct stomachic **emetic**, causing prompt vomiting without the depression which usually attends emetics, because the mustard reflexly stimulates the heart and respiration.

THERAPEUTICS.

External. A poultice made with linseed and having a little mustard (1 part to 16 of linseed) sprinkled on it is a very common and efficacious application as an irritant and counter-irritant in rheumatism, pleurisy, pneumonia, bronchitis, pericarditis, and many inflammatory diseases. In the manner already explained it will, when applied to the skin, soothe pain in gastralgia, colic, painful diseases of the chest, neuralgia, and lumbago. The paper or any of the mustard leaves that are sold, moistened in water, form an excellent application. Often the local application of mustard over the stomach relieves vomiting. A large mustard poultice applied to the legs was formerly used as a reflex stimulant in cases of syncope, asphyxia, and coma.

Common colds and febrile conditions, especially in children, are often treated by placing the feet and legs or the whole body in mustard and warm water (10 to 15 ounces of mustard to every 15 gallons of water, as hot as can be borne), the object being by the cutaneous dilatation to withdraw blood from the inflamed part. A mustard sitz bath may be taken at the period to induce menstruation.

Internal.—Mustard is used as a condiment, and also as an emetic. It is especially valuable for poisoning by narcotics, because of its reflex stimulant effects.

Thiosinamin.—(Not official.)

This is the usual name for Allylthiocarbamide, $C_4H_8N_2S$.

SOURCE.—It is prepared by warming oil of mustard with lcoholic solution of ammonia. *Solubility.*—1 in 18 water, 1 in 2 alcohol, 1 in 10 glycerin.

Dose, internally or subcutaneously, ½ **to 1½ gr. 3 to 10 centigrms.**

It has been largely used because it has been stated to soften cicatricial fibrous tissue. Thus it is given in cases of fibrous stricture of the œsophagus, pylorus, or urethra. Also for Dupuytren's contracture, parametritis, contracture due to scars, and deafness due to chronic fibrous conditions in the middle ear. In some cases a certain improvement is said to follow its use, in others none ensues. It is usually given as **Fibrolysin,** which consists of thiosinamin and sodium licylate in solution. This is injected subcutaneously or tramuscularly every other day, beginning with 20 m and creasing the dose to 40 for each injection. As it does not keep after exposure to air it is sold in ampullæ or glass bulbs.

CAJUPUT OIL.

Oleum Cajuputi. The oil distilled from the leaves Melaleuca leucadendron* and other species of *Melaleuca* atavia and Singapore.

CHARACTERS. A transparent, very volatile, limpid, pale ish green liquid, with a strong, penetrating, camphoraceous odour. Taste warm, bitter, aromatic, camphoraceous, and ucceeded by a sensation of coldness. Floats on water. Sp. r. 0·919 to 0·930. Readily soluble in alcohol.

COMPOSITION. The chief constituents are (1) Hydrate f cajuputene, or *cineol*, isomeric with Borneo camphor (see p. 640), 75 per cent. This is found in oil of eucalyptus *ee p.* 536) and other volatile oils. (2) Another oil.

IMPURITIES.—Other oils and copper.

Dose, ½ to 3 m.—3 to 18 centimils.

Preparation.

Spiritus Cajuputi. Oil of cajuput, 1 : alcoho (90 per cent.), 9.

Dose, 5 to 20 m. 3 to 12 decimils.

Oil of cajuput is contained in Linimentum Crotonis.

ACTION.

The action of cajuput oil is exactly the same a that of the oil of cloves (*see* p. 541).

THERAPEUTICS.

External. Cajuput oil is used as a stimulant irritant, and counter-irritant usually diluted with sweet oil for all sorts of purposes when any of thes effects are needed. Thus it is rubbed in for chilblains, myalgia, rheumatic pains, chronic inflammatory conditions of the joints or periosteum. It has also been employed as a parasiticide for *Tinea tonsurans*. The only objection to its use is its strong smell.

Internal.—It is occasionally given in dyspepsia, usually combined with other remedies, for the sake of its carminative, stomachic, and antispasmodic effects; it may be taken on sugar.

OIL OF EUCALYPTUS.

Oleum Eucalypti. The oil distilled from the fres leaves of *Eucalyptus globulus*, the blue gum tree, *Eucalyptu dumosa*, and other species of *Eucalyptus*. Australia.

CHARACTERS. Colourless or pale straw-coloured, becoming darker and thicker by exposure. Odour aromatic. Taste spicy, pungent, leaving a sensation of coldness in the mouth. Neutral. Sp. gr. 0·910 to 0·930. *Solubility*. In an equal weight of alcohol. The oils from different species of *Eucalyptus* vary very much.

COMPOSITION. The chief constituents are (1) A volatil oil, *eucalyptol*, about 70 per cent. It is that portion which in distillation passes over between 160 and 177 C. It is a mixture of (*a*) an irritating terpene called phellandrene, $C_{10}H_{16}$, and (*b*) cymene, $CH_3{\cdot}C_6H_4{\cdot}CH(CH_3)_2$. It is met with in commerce (2) A crystallizable resin, probably derived from the oil, an yielding ozone. (3) Tannin. (4) An oil, *cineol*, isomeric with hydrate of cajuputene (*see* p. 535). It is met with in commerce, and is called eucalyptol, or more properly crystallizable eucalyptol, as it solidifies at 0°C. It is found in many volatile oils.

INCOMPATIBLES. Alkalies, mineral acids, metallic salts.

Dose, ½ to 3 m. 3 to 18 centimils.

Preparation.

Unguentum Eucalypti. Oil of eucalyptus, 1; white soft paraffin, 5; hard paraffin, 4.

ACTION.

External. Oil of eucalyptus is much less irritant when applied externally than other volatile oils, but if its vapour is confined it will produce vesication and pustulation. It is powerfully **antiseptic** and **disinfectant.** Old oil is more antiseptic than new, probably from the greater amount of ozone it contains.

Internal. *Gastro-intestinal tract.* In medicinal doses oil of eucalyptus is stomachic, having the same actions as oil of cloves. In large doses it produces severe gastro-intestinal irritation, as shown by vomiting, diarrhœa, and abdominal pain.

Circulation. It, like **quinine**, arrests the movements of the white blood corpuscles; and it likewise resembles this drug in its antipyretic and its antiperiodic actions, and also, it is said, in causing contraction of the spleen; but quinine is in all respects the more energetic. In medicinal doses the heart is stimulated by oil of eucalyptus, and the blood-pressure rises; probably these effects are reflex from the stomach. After large quantities the action of the heart is enfeebled, and temperature falls.

Respiration. Small doses slightly accelerate, poisonous doses slow, respiration.

Nervous system. Large doses are powerfully depressant to the brain, to the medulla, and to th spinal cord, abolishing reflex action. Death occur from paralysis of respiration.

Mucous membranes, kidneys, and skin.—Lik other volatile oils, eucalyptus is excreted by all thes channels. It imparts its odour to, and disinfects the breath and the urine. It stimulates the organ by which it is excreted, consequently it is a diaphoretic, a stimulating expectorant, a diuretic, and a stimulant to the genito-urinary tract. Large dose cause renal congestion.

THERAPEUTICS.

External.—It is used as an antiseptic for wounds sores, and ulcers. It is three times as powerful as carbolic acid, and is therefore preferred by some surgeons. A eucalyptus gauze has been prepared as a dressing for wounds, which may be washed with a weak solution of the oil in alcohol. An ointment of eucalyptus oil 8 pts., iodoform 1 pt., hard paraffin and vaseline 40 pts. of each is applied to chancres. An emulsion of the oil is used as a urethral injection. It would probably be an efficient parasiticide.

Internal. A vapour or a spray of oil of eucalyptus has been recommended for diphtheria and foul bronchitis, and it is sometimes given by the mouth to correct the fœtor of the expectoration. Occasionally it is used for its stomachic, carminative effects, especially if the fæces are very foul-smelling, and some employ it in cystitis and pyelitis. It has been prescribed in septicæmia. As an antiperiodic for ague and an antipyretic it is far inferior to quinine.

OIL OF ROSEMARY.

Oleum Rosmarini.—The oil distilled from the flowering tops of *Rosmarinus officinalis.*

CHARACTERS.—A colourless or pale yellow volatile oil. Odour of rosemary. Taste warm aromatic. Sp. gr. 0·895 to 0·920.

Composition. The chief constituents are (1) The terpene, pinene. (2) Cineol. (3) Borneol, an alcohol isomeric with geraniol (p. 559). (4) Linalool (p. 551). (5) Menthol (p. 644).

Preparation.

Spiritus Rosmarini. Oil of rosemary, 1, alcohol (90 per cent.), 9.

Oil of rosemary is contained in Linimentum Saponis and Tinctura Lavandulæ Composita.

ACTION AND THERAPEUTICS.

Oil of rosemary has an action similar to that of other aromatic volatile oils. It is very commonly used to give a pleasant scent to hair lotions and other preparations which are used externally.

ARNICA FLOWERS.

Arnicæ Flores.—The dried flower heads of *Arnica montana.*

Characters. Receptacle flat bristly with two rows of dark green hairy bracts. Each ray floret shrivelled, dark yellow corolla. Disc florets numerous, yellow. Fruits, slender shrivelled.

Composition. Contains a volatile [illegible]

Preparation.

Tinctura Arnicæ Florum. 1 in 10 of alcohol (40 per cent.). Percolate.

Dose, ½ to 1 fl. dr. 2 to 4 mils.

ACTION AND THERAPEUTICS.

This tincture may be used externally as an application for bruises. Internally the tincture of the flowers is thought to be more active than one of the root, which was official in the Pharmacopœia of 1898, and is supposed to be useful in fevers, delirium tremens, and melancholia.

OIL OF LEMON GRASS.

Oleum Graminis Citrati. *Synonym.* India oil of verbena. The oil distilled from *Cymbopogon citratu* and *Cymbopogon flexuosus.*

Characters.—A dark yellow oil, with an odour o verbena. Sp. gr. 0·88 to 0·905.

Dose, ½ to 3 m.—3 to 18 centimils.

Action and Therapeutics.

This oil is chiefly used in perfumery and t adulterate oil of verbena, which it closely resembles. Externally it is mixed with twice its bulk of any fixed oil as a rubefacient to relieve pain in myalgia and rheumatism. Internally it is carminative. I is used chiefly in India, the East and West Indies.

Class II. of **Volatile Oils**.

Those used chiefly for their action on the gastro intestinal tract.

PYRETHRUM.

Pyrethri Radix. Pyrethrum. *Synonym.* Pellitory root. The dried root of *Anacyclus pyrethrum.* Levant.

Characters. Unbranched pieces, 5 to 10 centimetres long, 10 to 15 millimetres thick. Bark thick, brown, shrivelled; studded by dark-coloured receptacles for the resin. Close fracture, showing radiate surface. Inodorous. Causes a pricking sensation in the mouth when chewed. *Resembling pyrethrum.* Taraxacum, which is darker, and has not a burning taste.

Composition. The chief constituents are—(1) Volatile oils and resins. (2) Inulin.

Preparation.

Tinctura Pyrethri.—Powdered pyrethrum, 1; alcohol (70 per cent.), 5. Percolate.

Action and Therapeutics.

Pyrethrum is a powerful sialogogue, and causes a burning sensation in the mouth, followed by numbness and tingling. Small quantities give a pleasant taste to tooth powders.

CLOVES.

Caryophyllum. Cloves. The dried flower-buds of *Eugenia caryophyllata.* Penang, Bencoolen, and Amboyna.

CHARACTERS. About 15 millimetres long, consisting of a dark brown, wrinkled, subcylindrical, and somewhat angular calyx tube, which tapers below and is surmounted by four teeth, between which the paler-coloured petals, enclosing the numerous stamens and style, are rolled up in the form of a ball. Odour strong, fragrant, and spicy. Taste very pungent and aromatic. It emits oil when indented.

COMPOSITION. The chief constituents are—(1) *Oleum Caryophylli,* 18 per cent. (*see below*). (2) Eugenin, a crystalline body. (3) Caryophyllin, a neutral body isomeric with camphor.

Preparation.

Infusum Caryophylli.—1 in 40 of boiling water.
Dose, ½ to 1 fl. oz.—15 to 30 mils.

Cloves are contained in Infusum Aurantii Compositum.

Oleum Caryophylli. Oil of Cloves. The oil distilled from cloves.

CHARACTERS.—Colourless when recent, becoming yellowish and then brown. Taste and odour like cloves. Easily soluble in spirit or ether. Sp. gr. 1·047–1·065.

COMPOSITION. The chief constituents are (1) *Eugenol* (*synonym,* Eugenic acid), $C_{10}H_{12}O_2$, 85 per cent., which chemically resembles phenol, and forms permanent salts with alkalies. This is also found in oil of pimento. (2) A hydrocarbon, caryophyllene, $C_{15}H_{24}$.

Dose, ½ to 3 m.—3 to 18 centimils.

Oil of cloves is contained in Pilula Colocynthidis Composita, and Pilula Colocynthidis et Hyoscyami.

INCOMPATIBLES. Lime water, salts of iron, mineral acids, and gelatin.

ACTION OF CLOVES AND OIL OF CLOVES.

Oil of cloves is a typical example of a volatile oil the most important actions of which are exerted in the stomach.

External.—When rubbed into the skin it is **stimulant, rubefacient, irritant,** and **counter-irritant,**

and gives rise to considerable vascular dilatation
first it causes a sensation of **tingling** and pain, w
afterwards is replaced by local **anæsthesia.** It
parasiticide and antiseptic.

Internal.—*Mouth.*—In the mouth, oil of cl
produces the same effects as on the skin; there
burning sensation accompanied by vascular di
tion and an increased flow of saliva, and followe
local anæsthesia. Cloves stimulate the nerve
taste, and being volatile and aromatic, those of s
also; by both these means taste is sharpened.

Stomach.—The stimulant effect of cloves is e
rienced here. The **vessels** are **dilated**, excessive
irregular **peristalsis** is **lessened**, the secretion
gastric juice is **excited**, and as cloves are pleas
and aromatic, they do not ordinarily produce nau
consequently the **appetite** is **increased**. The c
bined effect of these actions is to aid digestive
cesses therefore oil of cloves is **stomachic**; an
facilitate the expulsion of gas thus it is **carminat**
The stimulation of the gastric nerves to a sl
extent reflexly affects the heart in the same wa
alcohol; therefore the **rate and force of the pulse**
moderately **increased.**

Intestines.—Here likewise oil of cloves dilates
vessels, and stimulates the secretion and diminis
colicky pains due to irregular contraction of
muscular coat, and flatus is expelled.

Circulation.—Oil of cloves is readily absor
from the intestine, circulates in the blood, and
said to increase the number of white corpusc
It may to a slight extent stimulate the heart direc
but the greater part of the stimulation of the h
excited by it is reflex from the stomach. It is credi
with the power of arresting painful spasmodic c
tractions in various parts of the body. It can,
we have seen, do this in the intestine, and possibl
may have to a slight extent the same action in

bronchial tubes and heart. This causes it to be called **antispasmodic.**

Mucous membranes. Like other volatile oils it is excreted by the kidneys, skin, bronchi, and genito-urinary tract, and in passing through these structures will act as a **stimulating disinfectant** to their secretion; but oil of cloves is never used for these purposes.

THERAPEUTICS OF CLOVES AND OIL OF CLOVES.

External. Oil of cloves is too dear for frequent external application, but on account of its local anæsthetic effect it has been used for neuralgia. It is employed to give a pleasant scent to liniments.

Internal. The oil is sometimes dropped into decayed teeth to relieve pain. Cloves are frequently employed in cookery for their taste, and because they stimulate the appetite and aid digestion. The oil or the infusion may be used medicinally as a stomachic, as a carminative, as an antispasmodic, or to relieve colicky pains in indigestion. It will have been noticed that oil of cloves is present in the two pills containing colocynth. This is to prevent the griping this purgative might otherwise cause.

BLACK PEPPER.

Black Pepper itself is not official but the confection is.

Preparation.

Confectio Piperis. *Synonym.* Ward's paste. Black pepper, 2; caraway, 3; purified honey, 15.
Dose, 60 to 120 gr. 4 to 8 grms.

Black pepper is contained in Pulvis Opii Compositus.

ACTION.

Pepper, because of its volatile oil, acts like other substances containing volatile oils; thus externally

it is at first rubefacient and counter irritant,
subsequently it acts as an anodyne. Internall
increases the secretions of the mouth, and in
stomach it is stomachic and carminative. Du
its excretion it stimulates the mucous membran
the genito-urinary tract. Piperine, a constituen
pepper, is believed to be a feeble antipyretic
antiperiodic.

THERAPEUTICS.

Occasionally pepper is used externally as
irritant for the same class of cases as must
Internally it may be employed, in the form
gargle, as a stimulant for relaxed conditions of
throat. It is taken in the form of a condin
for its stomachic properties. The confection
pepper lozenges are given empirically to rel
hæmorrhoids, ulcers of the rectum, and fissure
the anus.

NUTMEG.

Myristica.—Nutmeg. The dried kernel of the see
Myristica fragrans. Malay Archipelago.

CHARACTERS. Ovoid, about 25 millimetres long. E
nally greyish brown, with reticulated furrows. Inter
greyish red, marbled with brownish-red veins. Odour arom
Taste warm, bitter, aromatic.

COMPOSITION. The chief constituents are—(1) The
concrete oil, 25–30 per cent., which consists of Glyceryl ol
Glyceryl butyrate, and Glyceryl myristate. (2) The of
volatile oil, 2–8 per cent. (*see below*).

Nutmeg is contained in Pulvis Catechu Compositus, P
Cretæ Aromaticus, Spiritus Armoraciæ Compositus, and T
tura Lavandulæ Composita.

Oleum Myristicæ. Volatile oil of nutmeg.
oil distilled from nutmegs.

CHARACTERS. Colourless or pale yellow. Odour and
of nutmeg. Sp. gr. 0·87 to 0·925.

COMPOSITION.—The chief constituents are—(1)
terpene, pinene. (2) Myristicin. (3) Myristic acid.

Dose, $\frac{1}{2}$ to 3 m.—3 to 18 centimils.

Preparation.

Spiritus Myristicæ.—Oil of nutmeg, 1; alcohol (90 per cent.), 9.

Dose, 5 to 20 m.—3 to 12 decimils.

Oil of nutmeg is contained in Pilula Aloes Socotrinæ, Tinctura Guaiaci Ammoniata, Tinctura Valerianæ Ammoniata, and Spiritus Ammoniæ Aromaticus.

Spiritus Myristicæ is contained in **Mistura Ferri Composita.**

ACTION AND THERAPEUTICS.

The action of oil of nutmeg is the same as that of other aromatic oils. Nutmegs are much employed in cookery for the sake of their volatile oil, which is an agreeable stomachic. A Linimentum Myristicæ, containing one part of expressed oil of nutmeg to three of olive oil, is an elegant antiparasitic for mild cases of ringworm.

CINNAMON.

Cinnamomi Cortex.—The dried inner bark of shoots from the truncated stocks of the cultivated cinnamon tree, *Cinnamomum zeylanicum*. Ceylon.

CHARACTERS.—Closely rolled quills, 9 millimetres in diameter, and containing several smaller quills, thin, brittle, splintery. Externally dull light yellowish brown, with little scars and faint wavy lines. Internally darker brown. Odour fragrant. Taste warm, sweet, aromatic.

COMPOSITION.—The chief constituents are—(1) The official *volatile oil* (*see* p. 546) 0·2 to 1 per cent. (2) *Tannin*. (3) Sugar and gum.

IMPURITY.—Cassia bark.

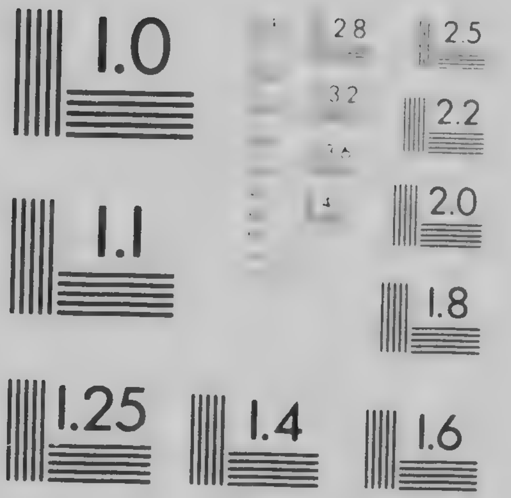
Cinnamon is contained in Pulvis Catechu Compositus, Pulvis Cretæ Aromaticus, Pulvis Kino Compositus, Decoctum Hæmatoxyli, Tinctura Cardamomi Composita, and Tinctura Lavandulæ Composita.

Preparations.

1. **Aqua Cinnamomi.**—1 in 10.

Dose, 1 to 2 fl. oz.—30 to 60 mils.

MICROCOPY RESOLUTION TEST CHART



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2. Pulvis Cinnamomi Compositus.—Ci
mon, 1; cardamoms, 1; ginger, 1.
Dose, 10 to 60 gr.—6 to 40 decigrms.

3. Tinctura Cinnamomi. Cinnamon, 1;
hol (70 per cent.), 5. Percolate
Dose, ½ to 1 fl. dr.—2 to 4 mils.

Aqua Cinnamomi is contained in Mistura C
Mistura Guaiaci, Mistura Olei Ricini, Mistura Spi
Vini Gallici, Syrupus Aromaticus, and Syrupus
caræ Aromaticus.

Compound cinnamon powder is contained in P
Aloës et Ferri and Pilula Cambogiæ Composita.

Oleum Cinnamomi. The oil distilled from ci
mon bark.

Characters.—Yellowish, becoming cherry-red on kee
Odour and taste like cinnamon. Sp. gr. 1·000 to 1·030.

Composition.—The chief constituents are—(1) Ci
mic aldehyde, which makes up the greater part. (2) A ter
(3) Eugenol (*see* p. 541).

Dose, ½ to 3 m.—3 to 18 centimils.

Preparation.

Spiritus Cinnamomi.—Oil of Cinnamo
alcohol (90 per cent.), 9.
Dose, 5 to 20 m.—3 to 12 decimils.

Spirit of cinnamon is contained in Acidum
phuricum Aromaticum.

Action and Therapeutics.

Oil of cinnamon has the same action as o
aromatic volatile oils, and is therefore stomachic
carminative. Cinnamon bark in addition has
virtue of its tannic acid, some astringent action,
is consequently a common flavouring stoma
vehicle for astringent powders and mixtures, ex
such as contain iron. Finely powdered cin
(60 to 90 gr., 4 to 6 grm.) is sometimes given mor
and evening in acute dysentery.

OLIVER BARK.

Oliveri Cortex. *Synonym.* Black Sassafras. The dried bark of *Cinnamomum oliveri.*

CHARACTERS.—Flat pieces 20 centimetres long and 4 centimetres wide. Covered with a grey brown warty cork. The inside of the bark is umber brown; odour and taste camphoraceous.

Preparation.

Tinctura Oliveri Corticis. 1 in 10 of alcohol (60 per cent.). Percolate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

ACTION AND THERAPEUTICS.

This bark may be employed for the same purposes as cinnamon, and some give it instead of sassafras. It is used chiefly in Australia.

HORSERADISH.

Armoraciæ Radix.—Horseradish Root. The fresh root of *Cochlearia armoracia.* Collected from cultivated plants.

CHARACTERS.—A long, cylindrical, fleshy root, enlarged at the upper end, where it is marked by scars of fallen leaves 12 to 25 mm. in diameter, and usually 30 centimetres or more long. Pale yellowish or brownish white externally; whitish and fleshy within. Taste very pungent. Inodorous unless bruised or scraped, when it gives a pungent odour. *Resembling horseradish root.*—Aconite root, which is shorter, conical, not cylindrical, darker, and causes tingling and numbness when chewed.

COMPOSITION.—The chief constituent is a substance which, by the action of a ferment, yields a volatile oil butyl sulphocyanide, C_4H_9CNS

Preparation

Spiritus Armoraciæ Compositus.—Scraped horseradish root, 125; dried bitter orange peel, 125; nutmeg, 3; alcohol (90 per cent.), 625; water, 750.

Dose, 1 to 2 fl. dr.—4 to 8 mils.

ACTION AND USES.

Horseradish is a condiment having the s
action as mustard. It has been used as a cour
irritant. The spirit is a pleasant flavouring
carminative agent.

CAPSICUM.

Capsici Fructus. *Synonyms.*—Guinea pep
Pod pepper. The dried ripe fruit of *Capsicum minim*
Zanzibar.

CHARACTERS.—12 to 20 millimetres long, 6 millimetre
diameter, shrivelled, fusiform. Consists of a dull red, shin
smooth, brittle, translucent pericarp, enclosing several sm
roundish, flat seeds. Odour peculiar, pungent. Taste
bitter.

COMPOSITION. The chief constituents are (1) Capsai
a crystallizable acid substance. (2) Capsicine, a vola
alkaloid smelling like conine. (3) A volatile oil. (4
resin. (5) Fatty matter.

Dried and powdered it constitutes red pepper.

IMPURITIES.—Various red substances, *e.g.* red-lead.

Preparations.

1. Tinctura Capsici.—Capsicum, 1; alco
(60 per cent.), 20. Macerate.

Dose, 5 to 15 m.—3 to 10 decimils.

2. Unguentum Capsici. — Capsicum,
hard paraffin, 10; soft paraffin, 75; prepared lard,

In India prepared suet should be used instead
prepared lard.

The Tincture is contained in Tinctura Chlorofor
et Morphinæ Composita.

ACTION.

The action of capsicum is like that of volatile o
generally. Thus externally it is a powerful rub
facient, irritant, and counter-irritant. Internally
small doses it stimulates the gastric secretions, caus
dilatation of the gastric vessels, and excites the mu
cular coat. It is therefore stomachic and carminativ

THERAPEUTICS

External.—Capsicum ointment is used as a counter-irritant for pleurisy, sciatica, neuralgia, and rheumatic pains. Capsicum plaster made with rubber is sold. The official tincture is too weak for external use, and the Tinctura Capsici Fortior (B. P. C.) is often too strong; and Martindale advises capsicum fruit 10, percolate with alcohol (90 per cent.) 70, add oleic acid 10 and oil of lavender ½: paint on skin or apply sprinkled on lint covered with gutta percha; its action may be arrested by smearing with vaseline. Unguentum Oleoresinæ Capsici Co. (B. P. C.) is the same as the well-known Chillie paste and is an excellent counter-irritant. Capsicum plasters containing no lead are applied to the gums for toothache. Wool impregnated with capsicum is applied in chronic rheumatism.

Internal. It is used as a condiment. Medicinally it is given as a stomachic and carminative in dyspepsia when it is required to excite the appetite and digestion, or to cause the evacuation of gas.

GINGER.

Zingiber.—The scraped and dried rhizome of *Zingiber officinale.* East and West Indies.

CHARACTERS.—Flattish, irregularly branched pieces, usually 7 to 10 centimetres long, each branch marked at its summit by a depressed scar. Externally pale buff, striated, fibrous. Fracture mealy, short, rather fibrous. Odour agreeable, aromatic. Taste strong, pungent. *Resembling Ginger.*—Turmeric, which is yellow.

COMPOSITION.—The chief constituents are—(1) An aromatic volatile oil, giving the flavour. (2) Gingerol. (3) Several resins and allied bodies.

Preparations.

1. Syrupus Zingiberis.—Powdered ginger, 25; alcohol (90 per cent.), q.s.; syrup, to 1000.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

2. Tinctura Zingiberis.—Ginger, 1; a
(90 per cent.), 10. Percolate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

Ginger is contained in infusion of senna, compound
pill, compound urginea pill, the compound powde
cinnamon, kaladana, jalap, opium, rhubarb, and scamn

Tincture of ginger is contained in Acidum Sulphu
Aromaticum.

ACTION AND THERAPEUTICS.

Its action is the same as that of other substa
containing aromatic volatile oils. It is chiefly
as a stomachic, carminative, and flavouring a
There is in commerce an oleo resin, gingerin (
resina Zingiberis, B. P. C.), which in doses of
1 gr. (15 to 60 milligrms.) is a useful additio
purgative pills to prevent griping; and Tin
Zingiberis Fortior (B. P. 1885), dose, 5 to 20 ♏
12 decimils), commonly called essence of ging
much used for flatulence.

CARDAMOMS.

Cardamomi Semina. Cardamom Seeds.
dried ripe seeds of *Elettaria cardamomum.* Malabar.
seeds should be kept in the pericarps, but when requir
use they should be separated.

CHARACTERS.—The fruit is a three-sided capsule,
centimetres long, of a tough papery character, ovoid, ob
triangular, shortly beaked, rounded at the base, pal
longitudinally striated; no odour or taste. Seeds 3 millin
long, irregularly angular, transversely wrinkled, reddish
externally, whitish within. Odour aromatic. Taste
aromatic.

COMPOSITION.—The chief constituents are (1) A v
oil, which contains a terpene called terpinene, $C_{10}H_{16}$.
fixed oil. The pericarp is medically inactive.

Preparation.

Tinctura Cardamomi Composita.—C
moms, 14; caraway, 14; cinnamon, 28; cochine

glycerin, 100; alcohol (45 per cent.), to make 1000. Macerate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

Compound tincture of cardamoms is contained in Decoctum Aloes Compositum, and Mistura Sennæ Composita.

Cardamoms are contained in Extractum Colocynthidis Compositum, Pulvis Cinnamomi Compositus, Pulvis Cretæ Aromaticus, Tinctura Gentianæ Composita, and Tinctura Rhei Composita.

ACTION AND THERAPEUTICS.

Cardamom seeds, because of their volatile oil, like cloves or pepper; therefore they are carminative and stomachic. As they have a pleasant taste, and the compound tincture is of a red colour, s much used as a colouring and flavouring agent. This tincture is a good flavouring carminative and Tinctura Carminativa (B. P. C. dose, 2 to 10 ♏ 1 to 6 decimils) is another. It contains cardamoms, strong tincture of ginger, oil of cinnamon, oil of araway, oil of cloves and rectified spirit.

OIL OF LAVENDER.

Oleum Lavandulæ. The oil distilled from the vers of *Lavandula vera.*

CHARACTERS. A colourless or pale yellow volatile oil. Odour of lavender. Taste warm, bitter. Sp. gr. 0·883 to 0·9.

IMPURITY. Oil of spike.

COMPOSITION. The chief constituents are—(1) Linalool tate (also found in oil of bergamot). (2) Linalool, C H OH, which is an alcohol and an oxidation product of the e myrcene $C_{10}H_{16}$. It is isomeric with borneol (p. 539), niol (p. 559), and menthol (p. 644). (3) Cineol, also found of eucalyptus (*see* p. 537) and other volatile oils.

Dose, ½ to 3 m.—3 to 18 decimils.

Preparations.

1. **Spiritus Lavandulæ.** Oil of lavender, 1; alcohol (90 per cent.), 9.

Dose, 5 to 20 m. 3 to 12 decimils.

2. Tinctura Lavandulæ Composita.— lavender, 5; oil of rosemary, 0·5; cinnamo nutmeg, 10; red sanders-wood, 20; alcohol (cent.), to produce 1000. Macerate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

Oil of lavender is contained in Linimentum Car Ammoniatum.

Compound tincture of lavender is contained in Arsenicalis.

Action and Therapeutics.

Oil of lavender has the same action as othe matic volatile oils. It is used externally as a ple stimulating component of liniments, and mos lotions (*see* p. 181) are coloured with the comp tincture. Internally, especially in the form c tincture, it makes a very agreeable gastric stim carminative, and colouring agent.

OIL OF PEPPERMINT.

Oleum Menthæ Piperitæ. The oil di from the fresh flowering peppermint, *Mentha piperita.*

CHARACTERS.—Colourless, pale, or greenish thickening and becoming reddish with age. Odour lik of peppermint. Taste aromatic, followed by a sense of ness. Sp. gr. 0·9 to 0·92.

COMPOSITION.—The chief constituents are—(1) *M* or mint camphor, $C_{10}H_{19}OH$, 50 to 65 per cent. (*see* p (2) Menthene, $C_{10}H_{18}$, a liquid terpene. (3) Menthyl ac

Dose, ½ to 3 m.—3 to 18 centimils.

Preparations.

1. Aqua Menthæ Piperitæ.—1 in 1000.

Dose, 1 to 2 fl. oz.—30 to 60 mils.

2. Spiritus Menthæ Piperitæ.—Oil of pe mint, 1; alcohol (90 per cent.), 9.

Dose, 5 to 20 m.—3 to 12 decimils.

Oil of peppermint is contained in Pilula Rhei Comp and Tinctura Chloroformi et Morphinæ Composita.

ACTION AND THERAPEUTICS.

The action of oil of peppermint is the same as that of volatile oils generally, but the cool numb feeling often produced by volatile oils after the sensation of warmth has passed off is especially well marked with oil of peppermint, and this effect, which is due to the menthol in it, has caused it to be applied externally in neuralgia. Like many other volatile oils it is a powerful antiseptic.

Internally it is a powerful stomachic and carminative, is often used as such, and also as a flavouring agent.

OIL OF SPEARMINT.

Oleum Menthæ Viridis.—The volatile oil distilled from the fresh flowering spearmint. *Mentha viridis* or *Mentha spicata.*

CHARACTERS.—Very like oil of peppermint.

COMPOSITION.—The chief constituents are—(1) *Menthene*, the same terpene as in peppermint. (2) *Carvone* or *Carvol*, $C_{10}H_{14}O$; also found in oil of caraway (*see* p. 556).

Dose, ½ to 3 m.—3 to 18 centimils.

Preparation.

Aqua Menthæ Viridis.—1 in 1000.
Dose, 1 to 2 fl. oz.—30 to 60 mils.

ACTION AND THERAPEUTICS.

These are the same as those of oil of peppermint.

ANISE.

Anisi Fructus.—Anise Fruit. The dried ripe fruit of *Pimpinella anisum.*

CHARACTERS.—Anise fruits are about 5 mm. in length, oval-oblong, greyish-brown in colour, and the whole surface is covered with short hairs. The two mericarps are united and attached to a common stalk; each is traversed by five pale slender ridges, and its transverse section exhibits about vittæ. Odour agreeable, aromatic. Taste sweetish, sp

COMPOSITION.—The chief constituent is the official oil (*see below*).

Preparation.

Aqua Anisi.—1 in 10.

Dose, 1 to 2 fl. oz.—30 to 60 mils—or

Oleum Anisi.—The volatile oil, distilled fro anise fruit (*see* p. 553), or from the star anise fruit (*I.* *verum*).

CHARACTERS.—Colourless or very pale yellow, wit odour of the fruit, and an aromatic, sweetish taste. 0·975 to 0·990.

COMPOSITION.—The chief constituents are—(1) An 85 per cent., $C_{10}H_{12}O$. (2) Anisic aldehyde. (3) M chavicol.

Dose, ½ to 3 m.—3 to 18 centimils.

Preparation.

Spiritus Anisi.—Oil of anise, 1; alcoho per cent.), 9

Dose, 5 to 20 m.—3 to 12 decimils.

Oil of anise is contained in Tinctura Camphoræ Comp and Tinctura Opii Ammoniata.

ACTION AND THERAPEUTICS.

The action of oil of anise is the same as tha aromatic oils generally. It is specially used to rid of flatulence in children, and, on account o slightly expectorant action, as a basis of co mixtures.

CORIANDER FRUIT.

Coriandri Fructus.—The dried ripe fruit of *andrum sativum.*

CHARACTERS.—Nearly globular, 5 millimetres in diam and consisting of two closely united hemispherical meric crowned by the calyx teeth and stylopod, brownish ye hard, faintly ribbed with both primary and secondary ri The mericarps each enclose a lenticular cavity, and ac ished on its commissural surface with two brown vittæ. Taste agreeable, mild, aromatic. Odour pleasant when bruised.

COMPOSITION.—The chief constituent is the official *volatile oil* (*Oleum Coriandri*).

Coriander fruit is contained in Confectio Sennæ, Syrupus Sennæ, Tinctura Rhei Composita, Tinctura Sennæ Composita.

Oleum Coriandri. A volatile oil distilled from the fruit.

CHARACTERS.—Colourless or pale yellow, with the odour and taste of the fruit. Sp. gr. 0·87 to 0·885.

COMPOSITION.—The chief constituents are—(1) Coriandrol, isomeric with linalool (*see* p. 551). (2) Pinene, the chief terpene of oil of turpentine, 5 per cent.

Dose, ½ to 3 m. 3 to 18 centimils.

Oil of coriander is contained in Syrupus Sennæ.

ACTION AND THERAPEUTICS.

Oil of coriander has the same action as other volatile oils. It is chiefly used as a stomachic and carminative, and to disguise the taste of rhubarb and senna.

FENNEL FRUIT.

Fœniculi Fructus. The dried ripe fruit of cultivated plants of *Fœniculum vulgare*. Malta.

CHARACTERS.—Small ovoid-oblong, straight or curved, smooth, greenish brown or brown, capped by a conspicuous stylopod and two styles. Odour aromatic. Taste aromatic, sweet. Fruit readily separated into its two mericarps, each of which has five prominent primary ridges, and exhibits in transverse section six large vittæ. *Resembling fennel.*—Conium fruit (fennel is larger and has prominent vittæ), caraway, and anise fruits.

COMPOSITION.—The chief constituent is a volatile oil probably identical with oil of anise.

Preparation.

Aqua Fœniculi.—1 in 10.

Dose, 1 to 2 fl. oz.—30 to 60 mils.

Fennel fruit is contained in Pulvis Glycyrrhizæ Compositus.

ACTION AND THERAPEUTICS.

The same as those of oil of anise or of corian
fruit.

CARAWAY FRUIT.

Carui Fructus. Caraway Fruit. The dried ripe
of *Carum carvi*.

CHARACTERS.—The fruit is usually separated into its
mericarps, each about 4 to 6 millimetres long, slightly cur
tapering at each end, brown, with five pale longitud
ridges; the transverse section of each mericarp exhibits
vittæ. Odour agreeable, aromatic. Taste pleasant, sweet
spicy. *Resembling caraway.* Conium and fennel. Kn
by the small ridges and the spicy taste of caraway.

COMPOSITION. The chief constituent is the vola
oil (*see below*).

Preparation.

Aqua Carui.—1 in 10.
Dose, 1 to 2 fl. oz. 30 to 60 mils.

Caraway fruit is contained in Pulvis Opii Composit
Confectio Piperis, Tinctura Cardamomi Composita, Tinct
Sennæ Composita.

Oleum Carui. The oil distilled from caraway fr
and rectified.

CHARACTERS. Colourless or pale yellow, with odour a
taste like the fruit. Sp. gr. 0·91 to 0·92.

COMPOSITION. The chief constituents are (1) Cyme
$CH_3C_6H_4{\cdot}CH(CH_3)_2$; also found in eucalyptus oil. (2) C
vone, $C_{10}H_{14}$; this is the essential constituent. (3) Dext
rotatory carvone or carvol, $C_{10}H_{14}O$, isomeric with thym
(*see* p. 643); also found in oil of spearmint (p. 55
(4) Limonene, a terpene, $C_{10}H_{16}$; also found in oil of lem
(*see* p. 646).

Dose, ½ to 3 m.—3 to 18 centimils.

Oil of caraway is contained in Pilula Aloes.

ACTION AND THERAPEUTICS.

The action and uses of oleum carui are the same
those of other aromatic volatile oils. It is employ
as a carminative, stomachic, and flavouring agent.

DILL FRUIT.

Anethi Fructus.—The dried ripe fruit of *Peucedanum graveolens.*

CHARACTERS.—Broadly oval, 4 mm. long, brown, flat, with a pale broad, membranous border. Mericarps distinct, each shows six vittæ. Odour and taste agreeable and aromatic. *Resembling dill.*—Conium, anise, fennel, caraway; but dill is winged.

COMPOSITION.—The chief constituent is the official *volatile oil (see below).*

Preparation.

Aqua Anethi. 1 in 10.
Dose, 1 to 2 fl. oz.—30 to 60 mils.

Oleum Anethi.—The oil distilled from the dill fruit.

CHARACTERS.—Pale yellow. Odour pungent. Taste hot and sweetish. Sp. gr. 0·900 to 0·915.

COMPOSITION.—The chief constituents are almost identical with those of caraway oil (*see* p. 556).

Dose, ½ to 3 m.—3 to 18 centimils.

ACTION AND THERAPEUTICS.

The same as those of anise and caraway. Dill water is a common carminative for children, and it covers very well the taste of sodium salts.

CHAMOMILE.

Anthemidis Flores. Chamomile Flowers. The dried expanded flower heads of *Anthemis nobilis.* Collected from cultivated plants.

CHARACTERS.—About 12 to 20 mm. in diameter, hemispherical, white or nearly white. Involucre composed of several rows of oblong bracts with membranous margins. Receptacle solid, covered with bracts. Florets ligulate and white. Odour aromatic. Taste bitter.

COMPOSITION.—The chief constituent is the official *volatile oil.*

Oleum Anthemidis.—The volatile oil distilled from chamomile flowers.

Characters. - Pale blue or greenish blue, becoming yel ish brown. Odour and taste like chamomile. Sp. gr. 0 to 0·915.

Composition. The chief constituents are (1) A terp $C_{10}H_{16}$. (2) Angelic and tiglic esters of isobutyl, amyl, hexyl alcohols. (3) A bitter principle.

Dose, ⅓ to 3 m. 3 to 18 centimils.

Action and Therapeutics.

A poultice made with chamomile flowers wa popular domestic remedy. All its virtues are to its warmth. Internally, like other volatile o oil of chamomile is a stomachic and carminati An infusion is in large doses a simple emetic.

ROSE PETALS.

Rosæ Gallicæ Petala. Red Rose Petals. T fresh or dried unexpanded petals of *Rosa gallica.* Fro cultivated plants. Britain.

Characters. Little cone-shaped masses or separa petals; purplish red, velvety. Odour fragrant, roseate. Tas bitterish, feebly acid, and astringent.

Composition. The chief constituents are (1) *Oleu Rosæ*, a volatile oil present in minute quantities (*see bel* (2) Tannic and gallic acids.

Preparations.

1. Confectio Rosæ Gallicæ.—*Fresh* petals, 1 sugar, 3.

2. Infusum Rosæ Acidum. *Dried* petals, 1 dilute sulphuric acid, ½; boiling water, 40. The su phuric acid makes it a darker red than it would othe wise be.

Dose, ½ to 1 fl. oz.—15 to 30 mils.

3. Syrupus Rosæ. *Dried* petals, 1 ; sugar, q.s. ; boiling water, 10.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

OIL OF ROSE.

Oleum Rosæ. *Synonym.*—Otto of Rose. The oil distilled from the fresh flowers of *Rosa damascena.*

Characters and Tests. - At ordinary temperatures a pale yellow crystalline semi solid, melting between 20° and 23 C., a pale yellow oil with a strong rose odour and taste. Sp. 0·854 to 0·862.

Composition.—The chief ingredient is geraniol or rho-l, a fragrant liquid. It is an alcohol and is related to lool, which occurs in oil of lavender (p. 551).

Preparations.

1. Aqua Rosæ.—Rose water. The rose water of commerce, prepared by distillation from the flowers of *Rosa damascena.* It is a saturated solution of oleum rosæ, and is diluted immediately before use with twice its volume of distilled water.

Dose, 1 to 2 fl. oz.—30 to 60 mils.

2. Unguentum Aquæ Rosæ. Rose water, 20; white beeswax, 18; purified borax, 1; almond oil, 61; oil of rose, 0·1. *Synonym.*—Cold Cream.

Rose water is contained in Mistura Ferri Composita and certain lozenges.

Action and Therapeutics.

The preparations of rose are pleasant vehicles, the confection for pills, the infusion, which is mildly astringent, for mixtures, the aqua for lotions, and the ointment for ointments. The syrup and the acid infusion are agreeable colouring agents.

BETEL.

Betel.—The dried leaves of *Piper betel.*

Characters.—Broadly ovate, acuminate, obliquely cor-te at base, glossy on upper surface. In commerce often ed or stitched in packets, about 15 centimetres long.

Action and Therapeutics.

Throughout the whole of India all classes of natives indulge in the habit of chewing betel leaves. White catechu and areca nut or betel nut, mixed with various spices and aromatics, are wrapped up in betel leaves which have been previously smeared with a little chunam or shell lime, and little masses of this mixture are chewed. This habit largely increases the amount of saliva. Betel leaves contain aromatic oil. Warm and smeared with oil they applied to the chest in bronchitis and pleurisy and the breasts to retard the secretion of milk.

Class III. or **Volatile Oils.**

Those used chiefly for their actions on the heart and cent nervous system.

VALERIAN.

Valerianæ Rhizoma.—Valerian Rhizome. T dried rhizome and roots of *Valeriana officinalis.* Collec in the autumn.

Characters.—Short, erect rhizome, entire or slic Externally dark yellowish brown, giving off many slend brittle, shrivelled rootlets, 7 to 10 centimetres long. Interna whitish. Odour developed in drying, strong, peculiar, disagr able. Taste unpleasant, camphoraceous, bitter. *Resembli valerian.*—Serpentary, arnica, green hellebore; but valeri is known by its odour.

Composition.—The chief constituents are—(1) *A volat oil* containing valerianic, formic, and acetic acids united w pinene, a terpene (*see* p. 525), and borneol (*see* p. 640). If t oil is kept it decomposes slightly and *valerianic acid*, HC_5H_9 is set free. This exists in many plants, and in cod-liver o The amount of it in valerian increases by keeping. It can derived from amylic alcohol, $C_5H_{11}OH$ (valeryl aldehyde). is colourless, oily, with the odour of valerian, and strong acid, with a burning taste. *Solubility.*—1 in 30 of wate easily in alcohol and ether.

Preparation.

Tinctura Valerianæ Ammoniata.—Powdere valerian, 200; oil of nutmeg, 3; oil of lemon, 2; solutio of ammonia, 100; alcohol (90 per cent.), 900. Macerat

Dose, ½ to 1 fl. dr.—2 to 4 mils.

Zinci Valerianas.—Zinc Valerianate. $Zn(C_5H_9O_2)$ $2H_2O$.

Source.—Obtained by saturating iso-valerianic acid wit zinc carbonate, or by the interaction of zinc sulphate an sodium iso-valerianate.

CHARACTERS.—Pearly scales with a feeble odour of valerian and a metallic taste. *Solubility.*—1 in 120 of water.

INCOMPATIBLES.—All acids, soluble carbonates, most metallic salts, vegetable astringents.

Dose, 1 to 3 grs.—6 to 20 centigrms.

ACTION.

Neither valerianic acid nor zinc valerianate is known to have any action.

Valerian itself acts in virtue of its volatile oil, which has the same properties as other volatile oils. Valerian is therefore an irritant when applied externally; internally it stimulates the mouth, stomach, and intestines; consequently it increases the appetite and the vascularity and the secretion, and regulates the peristaltic action of the stomach and intestines; and in its excretion, which takes place chiefly through the bronchial mucous membrane, kidneys, and genito-urinary mucous membrane, it excites the flow of fluids excreted through these parts. Acting reflexly from the stomach, it stimulates the circulation rather more powerfully than most volatile oils.

THERAPEUTICS.

Preparations of valerian, or still better the oil (2 to 5 ♏, 12 to 30 centimils) suspended in mucilage with cinnamon water, are often given as carminatives in cases of flatulence, and as reflex stimulants in fainting or palpitation. Valerian and valerianates sometimes relieve neuralgia; they are often prescribed for hysteria and other neurotic conditions, and sometimes with benefit. The Pilulæ Ferri Valerianatis Co. (B. P. C.) commonly called the Pill of Three Valerianates, containing a grain of Iron Valerianate, Quinine Valerianate, and Zinc Valerianate (dose 1 to 2 pills) is excellent for anæmic, neurotic women.

INDIAN VALERIAN.

Valerianæ Indicæ Rhizoma.—The dri
rhizome and rootlets of *Valeriana wallichii.*

CHARACTERS.—The rhizome is curved, about 5 cent
metres long, 5 to 10 millimetres diameter; dull brow
marked with transverse ridges; thickly studded with circu
prominent tubercles to which a few thick rootlets are attache
The crown has a number of bracts; the lower end is blun
The smell is characteristic.

Preparation.

Tinctura Valerianæ Indicæ Ammoniata.—
Indian valerian, 200; oil of nutmeg, 3; oil of lemo
2; solution of ammonia, 100; alcohol (60 per cent.
900. Macerate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

ACTION AND THERAPEUTICS.

The action and uses of Indian valerian are precisely the same as those of ordinary valerian. It i
used chiefly in India and the East.

ASAFETIDA.

Asafetida.—An oleo-gum-resin obtained by incisio
into the root of *Ferula fœtida,* and probably other specie
of *Ferula.* **Afghanistan and the Punjaub.**

CHARACTERS.—Usually in irregular masses, composed o
dull yellow tears agglutinated together by darker coloured
softer material. When broken or cut, the exposed surface ha
an amygdaloid appearance; the fractured surface is opaque
milk-white at first, but becomes first purplish pink and finall
dull yellowish brown. Odour strong, alliaceous, persistent
Taste bitter, acrid, alliaceous. Asafetida forms a white emulsion with water. The fractured surface of a tear, on bein
touched with sulphuric acid, becomes a fine red. *Resemblin
asafetida.*—Galbanum, ammoniacum, and benzoin, distinguished by their peculiar odours, which differ markedly fro
that of asafetida.

COMPOSITION.—The chief constituents are—(1) *A volatil*

7.5 per cent., containing essential oil of garlic, persulphide of allyl, $(C_3H_5)_2S$. This gives asafetida its very unpleasant odour. (2) Bassorin resin, 65 per cent. (3) Gum, 25 per cent.

IMPURITIES.—Earthy matter.

Dose, 5 to 15 gr. 3 to 10 decigrms.

Preparations.

1. **Pilula Aloes et Asafetidæ.**—Asafetida, Socotrine aloes, hard soap, and confection of roses, equal parts with syrup of glucose.

Dose, 4 to 8 gr. 25 to 50 centigrms.

2. **Spiritus Ammoniæ Fetidus.**—Asafetida, 75; strong solution of ammonia, 100; alcohol (90 per cent.), 1000.

Dose, 20 to 40 m.—12 to 25 decimils for repeated. **60 to 90 m. 4 to 6 mils** for single administration largely diluted.

3. **Tinctura Asafetidæ.**—Asafetida, 2; alcohol (70 per cent.), 10. Macerate.

Dose, ½ to 1 fl. dr.—2 to 4 mils. The resin precipitates on the addition of water, but may be redissolved in ammonia or suspended in mucilage.

ACTION.

Both internally and externally, asafetida, in virtue of its volatile oil, acts like volatile oils generally. Its action as a regulator of the intestinal muscle is especially well marked, hence it is combined with aloes in Pilula Aloes et Asafetidæ; and the enema of it will relieve flatus. Owing to its containing oil of garlic it is extremely nasty, and therefore it is not, like many volatile oils, available as a condiment. Its taste is credited with some mental effect in cases of hysteria.

THERAPEUTICS.

Asafetida is not used externally. Internally it is prescribed to aid the action of other purgatives, and also to stimulate the muscular coat to expel flatus. It may be given by the mouth or as an enema (30 gr., 2 grms., rubbed up with water 4 fl. oz., 120 mils).

Partly on account of its reflex stimulating effect, b also on account of its very nasty taste, it is used to co trol hysterical, emotional, and other mental distur ances, but it often fails. For this purpose it may combined with valerian. Cases of malingering ma sometimes be cured by making the patient take, thr times a day, an effervescing draught containing few minims of each of the tinctures of valerian an asafetida, with some mucilage to suspend th precipitated resin. The effervescence makes th nasty taste of these medicines "repeat" in the mout for some time after taking them. Hysteria may b benefited in the same way. Asafetida oil would i the course of its excretion disinfect the urine an the expectoration, but its smell forbids its use fo these purposes.

AMMONIACUM.

Ammoniacum. A gum-resin exuded from th flowering and fruiting stem of *Dorema ammoniacum* an possibly other species. Persia and the Punjaub.

Characters. Small roundish tears, or masses of agglu tinated tears; pale brown externally, milky white and opaqu internally. Hard and brittle when cold, with a dull wax, fracture, but softening with heat. Odour faint, peculiar, non alliaceous. Taste bitter, acrid. Forms a nearly white emulsion with water. *Resembling ammoniacum.*—Asafetida, galbanum benzoin, known by odour.

Composition.—The chief ingredients are—(1) Volatil oil, 4 per cent. (2) Resin, 70 per cent. (3) Gum, 20 per cent

Dose, 5 to 15 gr.—3 to 10 decigrms.

Preparation.

Mistura Ammoniaci.—Ammoniacum, 3, addec gradually during trituration to 100 of water and 6 o syrup of tolu. It forms a milk-like emulsion.

Dose, ½ to 1 fl. oz.—15 to 30 mils.

Ammoniacum is contained in Pilula Ipecacuanhæ cum Scilla, Pilula Scillæ Composita, Pilula Ipecacuanhæ cum Urginea, and Pilula Urgineæ Composita.

ACTION AND THERAPEUTICS.

The actions of ammoniacum are precisely the same as those of volatile oils generally. It has been employed externally to aid, by its mildly irritating effects, the absorption of chronic inflammatory products, and internally in chronic bronchitis with offensive expectoration for the sake of the remote disinfectant expectorant effect that it has in the course of its excretion through the bronchial mucous membrane.

MYRRH.

Myrrha.—An oleo-gum-resin obtained from the stem of *Commiphora Myrrha* and probably other species. Arabia and Somaliland.

CHARACTERS. Roundish or irregularly formed tears or masses of agglutinated tears, varying very much in size. Externally reddish brown or reddish yellow; dry, covered with a fine powder; brittle. The fractured surface is irregular, brown, somewhat translucent, and oily. Odour agreeable, aromatic. Taste aromatic, acrid, bitter. Insoluble in water; when rubbed up with it, forms an emulsion.

COMPOSITION. The chief constituents are (1) *Myrrhin*, a resin, 23 per cent. (2) *Myrrhol*, $C_{10}H_{14}O$, a volatile oil, 2 per cent. (3) Gum, 60 per cent. (4) A bitter principle.

IMPURITIES. Many varieties of gum and gum-resins.

Dose, 5 to 15 gr.—3 to 10 decigrms.

Preparations.

1. **Tinctura Myrrhæ.**—Myrrh, 1; alcohol (90 per cent.), 5. Macerate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

2. **Pilula Aloes et Myrrhæ** (*see* Aloes).

Myrrh is contained in Decoctum Aloes Compositum, Mistura Ferri Composita, and Pilula Rhei Composita.

ACTION.

External.—Both externally and internally myrrh has the same actions as other substances containing a volatile oil. It is a mild disinfectant, and a stim lant to sores and ulcers.

Internal. It has the same effects in the mout It is a **stomachic carminative**, exciting the appetis the flow of gastric juice, and the vascularity ar peristalsis of the stomach and intestines. Th number of leucocytes in the blood is said to b increased by the administration of myrrh. It excreted by mucous membranes, especially th genito urinary and the bronchial, and it stimulate and disinfects their secretions in its passage throug them. Thus it becomes an expectorant, a uterin stimulant, and an emmenagogue.

THERAPEUTICS.

External.—Occasionally myrrh has been em ployed as a stimulant to sores and ulcers.

Internal.—It is, in the form of $\frac{1}{2}$ fl. dr. (2 mils of the tincture diffused through 1 fl. oz. (30 mils of water, used as a mouth wash and gargle fo sore spongy gums, relaxed throat, and other simila conditions, for which it is often combined with borax, as in the following formula: Myrrh, 1 eau de Cologne, 16; borax, 1; water, 3; syrup, 3 It is frequently given with purgatives for the sake of its carminative and stomachic properties. It is also commonly combined with iron when this drug is given for anaemia, but the reason for this is not clear. It is prescribed for amenorrhœa, and has been given for cystitis, and as a disinfectant expectorant for chronic bronchitis.

CLASS IV. OF **Volatile Oils.**

Those used chiefly for their action on the bronchial mucous membrane.

TEREBENE.

Terebenum. Terebene. A mixture of dipentene and other hydrocarbons.

Source.—Produced by agitating oil of turpentine with successive portions of sulphuric acid until it no longer rotates the plane of a ray of polarized light, and then distilling in a current of steam.

Characters.—Colourless liquid, with a pleasant pine wood odour. It does not mix with water, but can easily be emulsified with tragacanth, or it may be taken on sugar or in capsules. Sp. gr 0·862 to 0·866.

Dose, 5 to 15 m.—3 to 10 decimils.

Action and Therapeutics.

Terebene is an excellent stimulating disinfectant expectorant for chronic bronchitis. It may be used as an inhalation thus: Terebene, 45 ♏ (3 mils); light carbonate of magnesium, 20 gr. (12 decigrms); distilled water, 1 fl. oz. (30 mils). Use a fluid drachm of this mixture in a pint of water at 50° C. in an apparatus so arranged that air can be drawn through it and inhaled. It may be given as an expectorant either in capsules, lozenges, or suspended in a mixture; many patients find five drops a few times a day on sugar quite sufficient to cure a slight winter cough. Terpin hydrate commonly called Terpine, a white solid, may be given in doses of 3 to 10 gr. (2 to 6 decigrms.) in a cachet, or suspended as an expectorant. It is made into an elixir with diamorphine hydrochloride (*see* p. 381).

BALSAM OF PERU.

Balsamum Peruvianum. A balsam exuded from the trunk of *Myroxylon pereiræ*, after the bark has been beaten and scorched. Salvador in Central America.

Characters.—A liquid about as viscid as treacle, nearly black in bulk; in thin layers orange or reddish brown, and transparent. Odour balsamic. Taste disagreeable, burning. *Solubility.* Insoluble in water, easily in chloroform, and in 1 of alcohol (90 per cent.), but on the addition of more alcohol the mixture becomes turbid.

Composition.—The chief constituents are—(1) A volatile oil. This is present in large quantities; it consists of cinnamein (cinnamate of benzyl), styracin (cinnamate of cinnamy C.H COOC.H.,, peruvin (benzyl alcohol), styrone (cinnam alcohol), and benzoate of benzyl. (2) Cinnamic ac C.H ·CH CH COOH (see p. 569). (3) Benzoic acid (see p. 64 (4) Resins.

Dose, 5 to 15 m. 3 to 10 decimils made into emulsion with mucilage or yolk of egg.

ACTION AND THERAPEUTICS.

External.—Like most substances containing volatile oil, balsam of Peru is a disinfectant, a also a stimulant when rubbed into the skin or appli to raw surfaces. Formerly it was much used f these purposes, chiefly as an application to indole sores and chronic eczema. A mixture of balsam Peru 1 part, lard 7 parts, is very useful for so nipples and cracked lips, but now it is not oft employed externally except as an antiparasitic f pediculi, scabies, and ringworm. For scabies should be applied in the way already described f sulphur ointment; it is a more agreeable preparatio

Internal.—Like most volatile oils balsam of Pe is carminative and stomachic, and after absorpti is excreted by, and stimulates and disinfects t mucous membranes. For this reason it is used an **expectorant** in chronic bronchitis. It is al excreted by the skin and the kidneys.

BALSAM OF TOLU.

Balsamum Tolutanum.—A balsam which incision exudes from the trunk of *Myroxylon toluiferu* New Granada.

CHARACTERS.—A reddish-yellow, soft, tenacious sol becoming hard by keeping and brittle in the cold. A le shows microscopic crystals of cinnamic acid. Very fragra odour. Taste aromatic. *Solubility.*—Easily in alcohol per cent.), not in water.

COMPOSITION.—The chief constituents are—(1) Tolue C.H.. (2) Benzoic acid (see p. 648). (3) Cinnamic a (*see below*). (4) Tolu-resinotannol. (5) Benzyl benzoate. (6) Benzyl cinnamate. (7) Vanillin.

Dose, 5 to 15 gr. 3 to 10 decigrms. as an emulsion with mucilage or yolk of egg.

Preparations.

1. Syrupus Tolutanus. Balsam of Tolu, 25; sugar, 660; water to make 1000 (contains very little balsam of tolu, as that is almost insoluble in syrup).

Dose, ½ to 1 fl. dr. 2 to 4 mils.

2. Tinctura Tolutana. Balsam of Tolu, 1; alcohol (90 per cent.), 10. Dissolve.

Dose, ½ to 1 fl. dr. 2 to 4 mils. The balsam of tolu is precipitated by adding water, therefore it should be suspended with mucilage.

Balsam of Tolu is contained in Tinctura Benzoini Composita.

Tincture of Tolu is contained in Trochisci Acidi Carbolici, Morphinæ, and Morphinæ et Ipecacuanhæ.

Syrup of Tolu is contained in Mistura Ammoniaci.

ACTION AND THERAPEUTICS.

Although it has an action in all respects similar to that of balsam of Peru, it is only used as an **expectorant** in cough mixtures.

STORAX.

Styrax Præparatus. Prepared Storax. A viscid balsam obtained from the wounded trunk of *Liquidambar orientalis* purified by solution in alcohol, filtration, and evaporation of the solvent. Asia Minor.

CHARACTERS.—A brownish-yellow, semi-transparent, semi-fluid balsam. Odour strong, agreeable. Taste balsamic.

COMPOSITION.—The chief constituents are (1) Styrene, $C_6H_5{\cdot}CH{\cdot}CH_2$, a derivative of cinnamic acid. (2) Cinnamic acid, $C_6H_5{\cdot}CH{\cdot}CH{\cdot}COOH$, colourless, odourless, crystalline, can be oxidized to benzoic acid, is also found in balsams of Tolu and Peru. (3) Styracin, which is cinnamate of cinnamyl, $C_8H_7COOC_9H_9$. (4) Two resins.

Storax is contained in Tinctura Benzoini Composita.

ACTION AND THERAPEUTICS.

Storax has just the same action as balsams Tolu and Peru and benzoin, and may be employ for the same purposes. It is not often given int nally except in the compound tincture of benzo Mixed with an equal part of olive oil it may be u to kill the *Sarcoptes hominis* and pediculi.

Cinnamic acid greatly increases the leucocytes the blood and the uric acid in the urine. Sodi cinnamate dissolved either in water or glycerin h been given subcutaneously or intravenously stimulate leucocytosis in cases of tuberculous disea and coumaric acid (a derivative of cinnamic ac has been used for phthisis and cancer, but neith has found much favour.

OIL OF SIBERIAN FIR.

Oleum Abietis.—*Synonym.*—Oil of Pine. The distilled from the fresh leaves of *Abies sibirica.* Rus Pinol and Pumiline are similar proprietary preparations.

This was called Oleum Pini, B. P. 1898.

CHARACTERS. Almost colourless. Odour aromatic. Ta pungent. Sp. gr. 0·90 to 0·92.

COMPOSITION. (1) Various terpenes. (2) Bornyl aceta

ACTION AND THERAPEUTICS.

The action of oil of Siberian Fir is the same that of oil of turpentine (*see* p. 526). It is pleasant to inhale, and forms a useful stimulating disinfecta expectorant inhalation in chronic bronchitis or lary gitis. To make an inhalation of it take of oil Siberian fir, 45 ♏ (3 mils); rub with 20 gr. (12 de grms. of light carbonate of magnesium, which hel to suspend it; add water, 1 fl. oz. (30 mils). P 1 fl. dr. (4 mils) of this in a mixture of half a pi of cold and half a pint of boiling water in a vess so arranged that air drawn through the fluid can inhaled.

Syrupus Pini (B. P. C.), containing oil of pi and tincture of saffron—dose, ½ to 1 fl dr., 2 to 4 mils. is a good ingredient of expectorant mixtures.

CLASS V. OF **Volatile Oils**.

Those used chiefly for their action on the kidneys and genito urinary tract.

OIL OF JUNIPER.

Oleum Juniperi. The oil distilled from the ripe fruit of *Juniperus communis*. North Europe.

CHARACTERS. Colourless or pale yellow. Odour characteristic. Taste warm, aromatic. Sp. gr. 0·862 to 0·890

COMPOSITION.—Oil of juniper is composed chiefly of terpenes, which are mostly pinene and cadinene.

Dose, ½ to 3 m.—3 to 18 centimils.

Preparation.

Spiritus Juniperi. Oil of juniper, 1; alcohol (90 per cent.), 9.

Dose, 5 to 20 m.—3 to 12 decimils.

This is twice as strong as in B. P. 1898

ACTION.

Oil of juniper has much the same action as oil of turpentine; but it is not so liable to upset the digestion; and although it is a powerful renal stimulant and **diuretic**, it does not easily cause hæmaturia and **albuminuria**.

THERAPEUTICS.

It is not used externally. Occasionally it is given as a pleasant carminative and stomachic, but its main use is as a diuretic in heart disease, hepatic ascites, and chronic Bright's disease. It must not be given in the acute form, and should always be combined with other diuretics. It markedly increases the quantity of the urine, which it causes to smell like violets. As it is a constituent of hollands and gin, these are good forms of alcohol for persons suffering from the above diseases.

BUCHU.

Buchu Folia. *Synonym.*—Bucco. The dried lea of *Barosma betulina*. Cape of Good Hope.

CHARACTERS.—From 12 to 20 millimetres long. Rhomb ovate, glabrous, dull yellowish green, marked on the marg especially the under surface, with oil-glands; peculiar str odour; aromatic, mint-like taste. *Resembling buchu.*—Se and Uva Ursi, which have entire leaves.

IMPURITY.—Leaves of *Emplanum serrulatum*, which h no glands.

COMPOSITION. The chief constituents are (1) A yellowi brown volatile oil from the glands; it consists of baros camphor in solution in a liquid hydrocarbon. The camp is deposited on exposure to air. (2) A bitter princi (3) Mucilage.

Preparations.

1. **Infusum Buchu.**—1 in 20 of boiling wate
Dose, 1 to 2 fl. oz.—30 to 60 mils.
2. **Tinctura Buchu.**—Buchu, 1; alcohol (60 p cent.), 5. Percolate.
Dose, ½ to 1 fl. dr.—2 to 4 mils.

ACTION AND THERAPEUTICS.

A medicinal dose of buchu causes a slight feelin of warmth in the stomach, and a large one gives ris to vomiting. The volatile oil diffuses into the bloo and is excreted by the bronchial mucous membran which it stimulates, and buchu is therefore occa sionally given as an expectorant. Most of the oil excreted by the kidneys, which are also stimulated, an thus buchu is a mild **diuretic.** In the process excretion it gives a peculiar odour to the urine, an acts as an astringent and **disinfectant to the urinar tract,** especially the bladder. It has consequently bee administered for **cystitis,** irritable bladder, **pyelitis** and gonorrhœa. Large doses continued for a lon time are said to damage the kidneys. The infusion contains very little of the oil. Alcoholic solution as the tincture, and a fluid extract which is sold, d not mix well with water on account of the oil i them. The action of buchu is much the same as that of pareira, but it is pleasanter to take, and is a good vehicle for diuretics.

COPAIBA.

Copaiba.—Copaiva. The oleo-resin obtained by incision from the trunk of various species of *Copaifera*. Valley of the Amazon, West and East Indies.

CHARACTERS.—A more or less viscous liquid, generally transparent and not fluorescent, but some varieties are opalescent and slightly fluorescent; light yellow to pale golden brown. Odour peculiar, aromatic; taste acrid, bitter. *Solubility.*—Not at all in water, almost entirely in absolute alcohol, ether, fixed and volatile oils, benzol, and in four times its bulk of petroleum.

COMPOSITION.—The chief constituents are—(1) *The official volatile oil*, 48 to 85 per cent. (*see below*). (2) *The resin*, 15 to 52 per cent. It exists dissolved in the oil. Dose, 10 to 20 gr. It is a brown resinous mass consisting of two resins: (*a*) copaivic acid ($C_{10}H_{30}O_2$), the chief constituent, a crystalline resin, with a faint odour, a bitter taste, insoluble in water, readily soluble in absolute alcohol and ammonia; (*b*) a non-crystallizable viscid resin, 1½ per cent.

IMPURITIES.—Turpentine, detected by the smell on heating. Fixed oils; these leave a greasy ring round the resinous stain when heated on paper. Gurjun balsam, which coagulates at 130°C.; copaiba does not.

Dose, ½ to 1 fl. dr. ~~2 to 4~~ mils in two and a half times as much mucilage of acacia.

Oleum Copaibæ.

SOURCE.—The volatile oil distilled from copaiba.

CHARACTERS.—Colourless or pale yellow, with the taste and odour of copaiba. Sp. gr. 0·896 to 0·91.

COMPOSITION.—It consists chiefly of the hydrocarbon caryophyllene (*see* p. 541).

Dose, 5 to 20 m. 3 to 12 decimils suspended in mucilage of acacia (1½ fl. oz. for every fl. oz. of oil of copaiba) or yolk of egg. Cinnamon or peppermint water, with tincture of orange or ginger, covers the taste. It may be dissolved in water with the aid of Liquor Potassæ, with which it forms a soap, or it may be given in capsules.

ACTION.

External.—Copaiba is a stimulant to the skin.

Internal.—*Gastro-intestinal tract.*—It acts li
other volatile oils. Small doses produce a feeling
warmth in the epigastrium, but with large doses
irritant effect leads to vomiting and diarrhœa.
taste is very nasty, and the eructations it may cau
are very disagreeable.

Mucous membranes.—Here also it acts like oth
volatile oils. It is quickly absorbed, and is th
excreted by all the mucous membranes, which
stimulates in its passage through them, increasi
their vascularity and the amount of their secretio
which if foul is disinfected. Because of these actio
it is a disinfectant **expectorant**, and a stimulati
disinfectant to the whole of the **genito-urinary tra**
It imparts a powerful odour to the breath a
mucous secretions. It is also excreted by the ski
and its irritant effect here is seen in the **erythemato**
rash it often produces. Some, too, passes out by t
milk.

Kidneys.—Copaiba has a more marked action
the kidneys than most substances containing volat
oils, and this is in great part due to the resin, whi
is particularly stimulating to the renal organs, a
copaiba is therefore a useful **diuretic**. Large dos
of it greatly irritate the kidney, as is shown by pa
in the loins and blood and albumen in the urin
The oil and resin are excreted in the urine, and t
resin can be thrown down from it by nitric aci
but this precipitate is known not to be albumen
the fact that it is evenly distributed through the flu
and is dissolved by heat. If the renal congestion
severe the urine may be very scanty.

THERAPEUTICS.

Genito-urinary tract.—Copaiba, or more usua
its oil, is largely used to stimulate and disinfect th

part of the body in cases of pyelitis, cystitis, vaginitis, and gonorrhœa. It is often prescribed for this last disease, and is best given when the acute symptoms have subsided, otherwise it may increase them.

Kidneys.—The resin which remains after distillation of the oil from copaiba is an admirable diuretic for hepatic and cardiac dropsy, but because of its liability to irritate the kidneys should not be given in Bright's disease. After a time patients seem to become accustomed to it, for the diuresis is not so marked as at first. It is nasty and difficult to make palatable. Fifteen grains (1 grm.) of the resin with 20 minims (12 decimils) of alcohol (90 per cent.), 15 grains (1 grm.) of compound tragacanth powder to suspend it, and a fluid drachm (4 mils) of syrup of ginger in an ounce (30 mils) of water may be given for a dose.

Bronchial mucous membrane.—Copaiba is occasionally used as a disinfectant expectorant when the secretion is very foul as, for example, when the bronchial tubes are dilated.

Skin.—Copaiba has been given in chronic skin diseases, as psoriasis, for the cutaneous stimulation caused by it, but it is now quite discarded.

The reasons why it is rarely used except in gonorrhœa, for which it would not be employed if it had not such a strongly marked beneficial action, are that the smell of the breath of those taking it is very disagreeable, it is very nasty to the taste, and often causes indigestion.

CUBEBS.

Cubebæ Fructus. Cubebs. The dried unripe full grown fruit of *Piper cubeba*. Java.

CHARACTERS.—Globular, 4 to 5 millimetres in diameter, black or greyish brown, wrinkled, tapering below into a rounded stalk, continuous with the pericarp, in which in the mature fruit the seed, but in commercial specimens this is often so little

developed that the pericarp is almost empty. Odour aromat
Taste warm, aromatic, bitter. *Resembling cubebs.*—Pepp
and pimento; neither has a stalk.

Composition.—The chief constituents are—(1) *The offic*
volatile oil, 6 to 15 per cent. (*see below*). (2) An *oleo-resin*
per cent., which contains much cubebic acid and cubeb
(3) Cubebin, a tasteless, insoluble, odourless substance.
Cubebic acid. (5) A little piperine.

Dose, 30 to 60 gr.—2 to 4 grms.

Preparation.

Tinctura Cubebæ. Cubebs, 1; alcohol (90
cent.), 5. Percolate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

Oleum Cubebæ.

Source.—The volatile oil distilled from cubebs.

Characters.—Colourless or greenish yellow with
odour and taste of cubebs. Sp. gr. 0·91 to 0·93.

Composition.—The chief constituents are—(1) Dipente
(2) Cadinene. (3) Cubeb-camphor.

Dose, 5 to 20 m.—3 to 12 decimils—suspended
mucilage.

ACTION.

External.—Like other substances containin
volatile oil, cubebs is rubefacient when rubbed i
the skin.

Internal.—Small doses are stomachic and c
minative, and improve digestion, but moderate do
are very liable to cause dyspepsia. Cubebs enters
blood, and, like so many volatile oils, slightly stim
lates the heart, and also excites the organs throu
which it is excreted. Occasionally, therefore,
causes an erythematous eruption on the skin
increases and disinfects the bronchial secretion, a
is consequently an expectorant; but its main act
is on the **genito-urinary passages**, the muc
membrane of which is powerfully stimulated, a
the secretions of which are disinfected. The kidn
are also irritated; hence cubebs is a **diuretic.**

ppears in the urine in a form (probably as a salt of ubebic acid) which may be precipitated by nitric cid.

THERAPEUTICS.

It is sometimes employed as lozenges, or as a owder, or as the smoke of cubebs cigarettes, to timulate the mucous membrane in cases of slight onchitis, chronic sore throat, or follicular pharyn s. Chronic nasal catarrh and hay-fever have been eated by insufflations of the powder. Asthma is metimes relieved by the cigarettes. Many popular onchial troches contain cubebs: in them it exer- es its expectorant action. Cubebs is rarely used a stomachic or cardiac stimulant, because it is so ble to upset digestion: but as it is less likely to o so than copaiba, is a little pleasanter to take, and almost as powerful a stimulant to the genito nary mucous membrane, it is largely used in et, gonorrhœa, and chronic cystitis.

OIL OF SANDAL WOOD.

Oleum Santali. *Synonym.* Santal oil. The vola oil distilled from wood of *Santalum album.* India.

CHARACTERS. Thick, viscid, pale yellow. Odour strongly matic. Taste pungent, spicy. Readily soluble in alcohol, r, or chloroform. Sp. gr. 0·973 to 0·985.

COMPOSITION.—It contains 90 per cent. of an alcohol, H OH.

Dose, 5 to 30 m. 3 to 18 decimils in capsules, or in emulsion.

ACTION AND THERAPEUTICS.

The action of sandal-wood oil is the same as that f volatile oils in general, but, like that of the oils of paiba and cubebs, it is especially manifested in the **genito-urinary mucous membranes**, which are **stimulated and disinfected**. The drug is used in gonor a and gleet; it is pleasanter than copaiba, but

more expensive. It appears in the urine h
hour after administration. Some of it is ex
by the bronchial mucous membrane; it is th
a stimulating disinfectant expectorant. T
three drops on sugar will frequently relie
hacking cough so often met with when but
sputum is expectorated.

GROUP VII.

Vegetable Bitters.

All these substances contain a bitter principle, whi
stimulates the functions of the stomach.

**Calumba, Gentian, Quassia, Cascarilla, Chire
Serpentary, Picrorhiza, Dandelion,
Orange Peel.**

CALUMBA.

Calumbæ Radix.—Calumba Root. The
transversely cut slices of the root of *Jateorhiza co*
From the forests of Eastern Africa north of the Zambe

Characters.—Flat, more or less circular slices, fr
to 5 centimetres in diameter, and 3 to 12 millimetres
Cortical part thick, with a wrinkled brownish-yellow
Centre softer, concave, and greyish yellow; there is
dark line between the two parts. Mealy fracture.
odour; bitter taste.

Composition.—The chief constituents are—(1) *Calu*
$C_{21}H_{22}O_7$, a neutral bitter principle crystallizing in
needles. (2) Berberine, an alkaloid, giving the yellow c
(3) Calumbic acid. (4) Starch, 33 per cent. No tan
present, so calumba can be prescribed with salts of iron

Preparations.

1. Infusum Calumbæ.—Calumba root, 1
water (to avoid extracting the starch), 20.

Dose, ½ to 1 fl. oz.—15 to 30 mils.

2. Tinctura Calumbæ.—Calumba roo
alcohol (60 per cent.), 10. Macerate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

ACTION.

External. Calumba is a mild antiseptic and disinfectant.

Internal. *Mouth.* Calumba is a typical **bitter**; its main action is in the mouth, for the appetite is sharpened because the gustatory nerves are stimulated; this reflexly leads to dilatation of the gastric vessels and to an increase in the gastric and salivary secretions.

Stomach.—The effects on the gastric mucous membrane which were brought about reflexly by the stimulation of the gustatory nerves are further exaggerated by the arrival of the saliva in the stomach; the immediate effect of a bitter in the stomach is to diminish the flow of gastric juice, but it is soon absorbed, and after absorption it may have the power slightly to increase the flow of gastric juice. The result of these actions is to cause a feeling of hunger, an extra secretion of gastric juice, and greater vascular dilatation, and all this **helps the digestion** of the food. Peristalsis in the stomach and intestine appears in some people to be made slightly more active, and thus calumba and other bitters may be **carminative.** Large doses have a paralytic effect on the secretion, and are very harmful. The long continued use of bitters leads to gastric catarrh and consequent indigestion.

Most bitters, like volatile oils, cause an increased migration of leucocytes from the intestinal glands into the blood.

Injected up the rectum bitters are **anthelmintic**, destroying the threadworm.

THERAPEUTICS.

Calumba is only employed to stimulate the gastric functions and improve the appetite in cases of chronic indigestion due to a general weakness of

action on the part of the stomach. It is thus a
of the large class of stomachics. It is espec
valuable in that form of dyspepsia in which
stomach participates in a general feebleness o
the organs of the body, such as we see in ana
starvation, convalescence from acute diseases, tu
culosis, and general exhaustion. Bitters should n
be used when there is acute or subacute gastrit
gastric ulcer, or pain. They will obviously mak
these conditions worse. They must not be too
centrated, nor be given for too long, lest they sh
over-irritate the stomach. They should alway
far as possible, be combined with modes of treatm
designed to relieve the cause of the dyspepsia. O
they are called tonics; all that is meant by th
that, as they render the digestion of food more e
the general health will improve. Most bitters, w
given as rectal injections, are anthelmintics for
Oxyuris vermicularis. Half a pint of the infusio
calumba may be thrown up the rectum of an adu

GENTIAN.

Gentianæ Radix. The dried rhizome and
of *Gentiana lutea.* Central and Southern European m
tains.

Characters.—Cylindrical, tough, brittle pieces or lon
dinal slices, with irregular longitudinal furrows. The rhiz
bears closely approximated leaf scars. Peripherally yello
brown; centrally reddish yellow. Bark thick, reddish. W
spongy, separated from bark by dark zone. Odour he
peculiar. Taste first sweet, then bitter.

Composition.—The chief constituents are—(1) *Ge*
picrin, the active, very bitter glucoside, soluble in w
and alcohol. Can be split up into glucose and gentioge
(2) Gentisic or gentianic acid united with gentio-pi
(3) A trace of a volatile oil. (4) Gentianose, a sugar. Gen
contains no tannin, but cannot be prescribed with i
because that darkens the colouring matter.

Incompatibles.—Iron salts, silver nitrate, and lead s

Preparations.

1. Extractum Gentianæ.—Aqueous.

Dose, 2 to 8 gr.—12 to 50 centigrms.

2. Infusum Gentianæ Compositum. Gentian, 1; dried bitter orange peel, 1; fresh lemon peel, 2; boiling water, 80.

Dose, ½ to 1 fl. oz.—15 to 30 mils.

3. Tinctura Gentianæ Composita. Gentian, 100; dried bitter orange peel, 37·5; cardamoms, 12·5; alcohol (45 per cent.), 1000. Macerate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

ACTION AND THERAPEUTICS.

Gentian has the same action as other bitters, such as calumba, and is employed for the same class of cases. It is more used than any other bitter, because its taste is pleasant and it is not astringent.

QUASSIA.

Quassiæ Lignum. The wood of the trunk and branches of *Picræna excelsa*. Jamaica.

CHARACTERS.—In billets or logs, varying in size, but often as thick as a man's thigh, and covered with a dark grey bark. Wood dense, tough, porous, yellowish white. Often seen as chips, shavings, or raspings. Inodorous. Intensely bitter. *Resembling quassia.*—Sassafras, but this is aromatic and not bitter.

COMPOSITION.—The chief constituents are (1) *Quassin*, a bitter neutral principle occurring in crystalline needles. (2) A volatile oil. No tannin is present, and therefore quassia can be prescribed with salts of iron.

Preparations.

1. Infusum Quassiæ.—Quassia, 1; cold water, 100. The water is cold to avoid extracting too much of the bitter principle.

Dose, ½ to 1 fl. oz.—15 to 30 mils.

2. Tinctura Quassiæ.—Quassia, 1; alcohol (45 per cent.), 10. Macerate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

ACTION AND THERAPEUTICS.

Quassia is an aromatic bitter stomachic, ac
in the same way as calumba. As it contain
tannin it is often prescribed with iron. The
objection to it is that some persons find it too bi
Injected *per rectum*, it is an excellent anthelm
for *Oxyuris vermicularis*; half a pint of the infu
may be given for this purpose.

CASCARILLA.

Cascarillæ Cortex.—The dried bark of *Cr*
eluteria. Bahamas.

CHARACTERS.—Quills, 3 to 10 centimetres long, 4 t
millimetres in diameter. Externally greyish white
under that a dull brown cortex. Fracture brown, sh
resinous. Odour agreeable, aromatic, especially when bur
Taste warm, bitter. *Resembling cascarilla.*—Pale cinch
which is less white, smooth and small.

COMPOSITION.—The chief constituents are—(1) *Ca*
rillin, a bitter neutral crystalline substance. (2) Vol
oils. (3) Resins. (4) Tannin.

INCOMPATIBLES.—Mineral acids. Lime water. Met
salts.

Preparations.

1. **Infusum Cascarillæ.** 1 in 20 of boiling wa
Dose, ½ to 1 fl. oz.—15 to 30 mils.

2. **Tinctura Cascarillæ.** Cascarilla, 1; alc
(70 per cent.), 5. Percolate.
Dose, ½ to 1 fl. dr.—2 to 4 mils.

ACTION AND THERAPEUTICS.

Because of its bitter principle cascaril
cascarilla, like other vegetable bitters, improves
digestion, and this stomachic and carminative act
is aided by the volatile oils in it. It is pleasant
take, and is suitable for the same cases as calum
The infusion will not keep good for more than a
unless a tincture is added to it. Mineral acids p
cipitate the resin from the tincture; therefore
infusion should be prescribed with them.

CHIRETTA.

Chirata. The dried plant *Swertia chirata*, collected when in flower and dried. Northern India.

CHARACTERS.—Stem 1 metre or more long, rounded below, quadrangular, winged and much branched above; smooth, orange-brown or purplish; consists of a thin woody ring enclosing much yellow pith. Branches slender, decussate. Leaves opposite, entire, ovate, 5 to 7 ribbed. Flowers small, numerous, panicled. Root oblique. Odour none. Taste very bitter. *Resembling chiretta.*—Lobelia, which is not bitter.

COMPOSITION.—The chief constituents are—(1) *Chiratin*, an active bitter, amorphous principle. (2) Ophelic acid, with which it is combined. No tannin is present.

Preparations.

1. **Infusum Chiratæ.**—1 in 20 of boiling water.
Dose, $\frac{1}{2}$ to 1 fl. oz. 15 to 30 mils.

2. **Tinctura Chiratæ.**—Chiretta, 1; alcohol (60 per cent.), 10. Percolate.
Dose, $\frac{1}{2}$ to 1 fl. dr. 2 to 4 mils.

ACTION AND THERAPEUTICS.

Chiretta has the same actions and uses as gentian, calumba, and other bitters. As it contains no tannin, it can be given with iron. It is more used in India than in England.

SERPENTARY.

Serpentariæ Rhizoma. Serpentary Rhizome. The dried rhizome and roots of *Aristolochia serpentaria* and *Aristolochia reticulata*. North America.

CHARACTERS.—The rhizome of *A. serpentaria* is 3 millimetres thick, 2 centimetres long. Upper surface, remains of former stems: under surface, a tuft of slender rootlets, about 7 centimetres long. Dull yellowish brown. Odour aromatic, camphoraceous; taste bitter, aromatic, camphoraceous. The rhizome and roots of *A. reticulata* resemble the foregoing but are longer and thicker. *Resembling serpentary.*—Arnica, valerian (*q.v.*). The rhizome deteriorates by keeping.

COMPOSITION.—The chief constituents are—(1) A bitter principle, aristolochin. (2) A volatile oil. (3) Resin.

Preparation.

Tinctura Serpentariæ. Serpentary, 1 : a
(70 per cent.), 5. Percolate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

Serpentary is contained in Tinctura Cinchonæ Comp

ACTION AND THERAPEUTICS.

In the small doses in which serpentary is g
in medicine it is a bitter stomachic, acting just
calumba or cascarilla, and it is used for the s
class of cases. It is rarely prescribed alone.
large doses it produces vomiting and purg
Many virtues have been attributed to it whic
does not possess.

PICRORHIZA.

Picrorhiza. The dried rhizome of *Picror*
Kurroa.

CHARACTERS. Generally about the size of a goose-
the lower part covered by a shrivelled, greyish brown, c
bark, and marked by prominent leaf scars and small b
Taste very bitter.

Dose, 10 to 20 gr.—6 to 12 decigrms. as a to
45 to 60 gr.—3 to 4 grms. as an antiperiodic. Giv
powder.

Preparations.

1. Extractum Picrorhizæ Liquidum.
1 of alcohol (60 per cent.). Percolate.

Dose, 15 to 60 m.—1 to 4 mils.

2. Tinctura Picrorhizæ. 1 in 4 of alc
(45 per cent.). Macerate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

This is twice the strength of the preparation
Addendum 1900 to B. P. 1898

ACTION AND THERAPEUTICS.

This drug, which is known as 'kali-kutki,
extremely bitter and is usually given combi

with aromatics as a bitter. It is also used as an antiperiodic. Used chiefly in India and the East Indies.

DANDELION ROOT.

Taraxaci Radix. The fresh roots of *Taraxacum officinale.* Collected in the autumn.

CHARACTERS. About 3 decimetres long, 12 millimetres in diameter. Externally smooth, yellowish brown. Internally white. Milky juice. Fracture short, showing yellow, porous, woody axis, with irregular concentric rings and a thick whitish bark. No odour. Taste bitter. *Resembling taraxacum.* Pellitory, which is pungent when chewed.

COMPOSITION. The chief constituents are (1) Taraxacin, a neutral principle. (2) Taraxacerin. (3) Asparagin (found also in asparagus, marsh mallow, liquorice, euonymus, &c.). Of no therapeutical value. (4) Inulin, mannite. (5) Salts. (6) Resins (which give the juice its milky appearance).

Preparations.

1. Extractum Taraxaci. Fresh extract. Made by evaporating the juice pressed out from the *fresh root.*

Dose, 5 to 15 gr. 3 to 10 decigrms.

2. Succus Taraxaci. *Fresh juice*, 3; alcohol (90 per cent.), 1.

Dose, 1 to 2 fl. dr.—4 to 8 mils.

ACTION AND THERAPEUTICS.

Dandelion is a simple bitter, and acts as a stomachic, just like calumba. It is also slightly laxative. It was formerly much more used than at the present day. It has been said to stimulate the flow of bile, but this is incorrect.

ORANGE PEEL.

Aurantii Cortex Recens.—Fresh Bitter Orange Peel. The fresh outer part of the pericarp of *Citrus Aurantium* (var. *Bigaradia*).

CHARACTERS well known.

Preparations.

1. Tinctura Aurantii.—Fresh bitter oran peel, 1; alcohol (90 per cent.), 4. Macerate.

Dose, ½ to 1 fl. dr. 2 to 4 mils.

2. Syrupus Aromaticus.—Tincture of orange, cinnamon water, 1; syrup, 2. *Synonym.*—Simple Elix

Dose, ½ to 1 fl. dr.—**2 to 4 mils.**

3. Syrupus Aurantii. Tincture of orange, 12 syrup, to produce 1000.

Dose, ½ to 1 fl. dr.—**2 to 4 mils.**

4. Vinum Aurantii.—A saccharine soluti to which fresh bitter orange peel has been added fermented. It contains 12 to 14 per cent. of alcoho

Vinum Aurantii is used to make Vinum Fe Citratis and Vinum Quininæ.

Tinctura Aurantii is contained in Confectio Sulphur Syrupus Cascaræ Aromaticus, Tinctura Quininæ, and Tr chisci Sulphuris.

Aurantii Cortex Siccatus.—Dried Bitter Oran Peel. The dried outer part of the pericarp of *Citrus aura tium* (var. *Bigaradia*).

Characters.—Thin pieces or strips, dark yellow colo almost free from the white inner rind. Odour fragra Taste aromatic and bitter.

Composition.—The chief constituents are (1) A fix oil, *Oleum Corticis Aurantii*, 1 to 2 per cent. Sp. gr. 0·84 0·86, which consists chiefly of a terpene, dextro-rotato limonene, $C_{10}H_{16}$. This oil is an ingredient of several elix (2) Three glucosides, hesperidin, isohesperidin, aurantiama (the bitter principle).

Preparations.

1. Infusum Aurantii.—Dried bitter orange pe 1; boiling water, 20.

Dose, ½ to 1 fl. oz.—15 to 30 mils.

2. Infusum Aurantii Compositum.—Dri bitter orange peel, 25; fresh lemon peel, 10; cloves, boiling water, 1000.

Dose, ½ to 1 fl. oz.—15 to 30 mils.

Dried bitter orange peel is contained in Spiritus Arm raciæ Compositus, Tinctura Cinchonæ Composita, Infusu Gentianæ Compositum, Tinctura Gentianæ Composita.

Aurantii Cortex Indicus. The fresh and dried outer part of the pericarp of varieties of *Citrus aurantium* grown in India and Ceylon. This is in India and the Eastern Colonies used for the same purposes as orange peel elsewhere.

Aqua Aurantii Floris. Orange Flower Water. The orange flower water of commerce prepared by distillation from the flowers of *Citrus aurantium* (var. *Bigaradia*) (the bitter orange tree). It is a saturated solution of the essential oil of the fresh flowers. In dispensing it is diluted with twice its volume of distilled water immediately before use.

CHARACTERS.—Colourless or slightly greenish; very fragrant; bitter taste.

COMPOSITION.—The chief constituents are—(1) A volatile oil, *Oleum Neroli*. (2) A bitter principle.

Dose, ½ to 1 fl. oz.—15 to 30 mils.

Preparation.

Syrupus Aurantii Floris. Orange flower water of commerce, undiluted, 150; sugar, 300; syrup to make 1000.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

Orange flower water, undiluted, is contained in Mistura Olei Ricini, and in Syrupus Calcis Lactophosphatis.

ACTION AND THERAPEUTICS.

The various preparations of the orange are used merely as flavouring agents, and Syrupus Aromaticus is especially useful. They are slightly bitter and stomachic.

GROUP VIII.

Vegetable Drugs containing Tannic Acid.

These are all astringent.

Galls, Catechu, Rhatany, Kino, Logwood, Hamamelis, Eucalyptus Gum, Acacia Bark, Bael Fruit, Myrobalans.

Galla.—Galls. Excrescences on *Quercus infectoria*, caused by the puncture and deposit of the eggs of *Cynips gallæ tinctoriæ*.

Characters.—Hard, heavy, subglobular, 12 to 18 millimetres in diameter: tuberculated on surface; the tubercl and the intervening spaces are smooth; dark bluish green or dark olive-green externally; yellowish or brownish whit within, with small central cavity. Odour none. Taste first astringent, then sweetish.

Composition. The chief constituents are (1) *Tanni* *acid*, 60 to 75 per cent. (2) *Gallic acid*, 2 to 5 per cent.

Incompatibles, *see* Tannic and Gallic Acids.

Preparations.

1. **Unguentum Gallæ.** Galls, 1; benzoated lard, 4.

In India benzoated suet should be used instead of benzoated lard.

2. **Unguentum Gallæ cum Opio.** Ointmen of galls, 925; opium, 75. *Strength.* This contain 7·5 per cent. of opium.

Acidum Tannicum. Tannic Acid. *Synonyms.* Tannin, Digallic acid. $C_{14}H_{10}O_9$.

Source.—Tannic acid may be extracted by water saturated with ether from galls which have been subjected to a special fermentation.

Characters.—A pale brownish powder, consisting of thin glistening scales. Taste strongly astringent. Reaction acid *Solubility.*—Freely in water or alcohol (90 per cent.); 1 in 1 of glycerin; 1 in 100 of ether. Gives a yellowish-white precipitate with gelatin (gallic acid does not), and this is the action that takes place when hides are tanned. There are many varieties of tannic acid in pharmacopœial plants. They all have a benzene nucleus, and mostly exist in glucosides.

Incompatibles. Mineral acids, alkalies. Salts of antimony, lead, silver, per-salts of iron. Alkaloids, gelatin, emulsions.

Dose, 5 to 10 gr. 3 to 6 decigrms. rarely give internally.

Preparations.

1. **Glycerinum Acidi Tannici.** Tannic acid 20; glycerin, 100.

2. Suppositoria Acidi Tannici. Tannic acid, 2·4 grms.; oil of theobroma q.s. to make twelve suppositories.

Each contains 0·2 grms. (about 3 grs.) of tannic acid.

3. Trochiscus Acidi Tannici.—0·03 grm. or ½ gr. in each, with a tolu basis.

ACTION.

External. Tannic acid is one of our most important drugs, because it coagulates proteins with great readiness; that is to say, it tans the tissues, for it is by coagulating the interstitial fluids in skins that tannic acid converts them into leather. The coagulated protein powerfully resists putrefaction. If an albuminous discharge is taking place from a sore or mucous surface and tannic acid is applied, the excreted fluid is coagulated, and the dense, insoluble coagulum forms a solid protecting layer which prevents further discharge. As the tannic acid soaks into the tissues it coagulates the albuminous fluids there also, and this still further hinders the discharge of fluid, therefore it is an energetic **astringent**. If bleeding is taking place, tannic acid of course coagulates the blood as it flows and the clots plug the vessels; at the same time the coagulum formed within the tissues, by its contraction, constricts the blood-vessels, and thus tannic acid becomes a powerful **hæmostatic**. It has no noteworthy direct effect on the vessels themselves. Tannic acid is mildly depressant to sensory nerves. Like other acids it is irritant, but it is very feebly so, and consequently its action in this direction is more than counterbalanced by its strongly astringent effects.

Internal. *Gastro-intestinal tract.*—Because tannic acid coagulates the mucous secretions and the fluids in mucous membranes, it makes the mouth dry and feel stiff when locally applied; in the stomach large doses prevent the secretion o gastric juice, decrease the flow of mucus, and may cause vomiting. For these reasons, and also because it precipitates proteins and pepsin, it interferes with digestion, but less than might be thought, because the precipitated protein is slowly broken up and converted into peptones, and they are not precipitated by tannic acid in an acid medium. It will check gastric hæmorrhage. In the intestine it is either converted into gallic acid or forms alkaline tannates, and until these alterations it acts as an intestinal astringent, controlling intestinal bleeding and causing constipation; but gallic acid and alkaline tannates have no astringent properties, therefore when drugs containing large amounts of tannic acid act as powerful intestinal astringents and hæmostatics, we must suppose that the amount of tannic acid taken is large enough for the conversion of it into salts or gallic acid, to take place slowly. Its administration leads to constipation, and the fæces are particularly hard.

It is absorbed chiefly as gallates, and to a much less extent as tannates.

Remote effects. Gallates and undecomposed alkaline tannates circulate in the blood, but they have no power to coagulate albumen, nor have they any astringent influence when locally applied, therefore it is difficult to believe that tannic acid has any remote astringent or hæmostatic effects; some claim that it has, but they have not proved their case. It is excreted in the urine of animals as gallates with traces of tannates, but in man no derivative of it can be detected in the urine or other secretions, so that any which has been absorbed is entirely decomposed in the body. Any excess passes out in fæces as tannates and gallates. Many vegetable substances such as logwood, depend, for their astringent properties, on the tannic acid they contain.

THERAPEUTICS.

The therapeutical applications of tannic acid are very numerous. It is used as an astringent for ulcers, sores, various moist eruptions, tonsilitis, pharyngitis, nasal catarrh, otorrhœa, gastric catarrh, diarrhœa (large doses of 30 grains may be given; catechu and logwood are favourite remedies), leucorrhœa, gonorrhœa, rectal ulcers, fissures, and prolapse. It is employed as a hæmostatic in bleeding from small wounds, ulcers, the gums, the pharynx, the nose, the stomach, the intestine, hæmorrhoids, and the bladder. Collodium Stypticum (B. P. C.) contains tannin, and is a useful external remedy. Whenever practicable a good method of application is to dust tannic acid on the part, especially for hæmorrhage: if this is gastric or intestinal 30 grains (2 grms.) or more should be frequently given by the mouth. For external use or for application to the throat the Glycerinum is useful. A gargle of 1 fl. dr. (4 mils) of the glycerinum to 1 fl. oz. (30 mils) of water may be made. The lozenges are convenient for pharyngitis. A spray (6 to 10 gr., 40 to 60 centigrms., in 1 fl. oz., 30 mils, of water) or an insufflation of tannic acid and starch may be used for the mouth and larynx. The ointment of galls and opium is a favourite application for piles. The suppositories are useful for rectal discharges. Solutions of 10 gr. (6 decigrms.) to 1 fl. oz. (30 mils) of water may be injected into the urethra for gonorrhœa and urethritis, and into the bladder for cystitis. A decoction of oak bark, employed as a rectal injection, destroys the threadworm. Tannigen (diacetyl tannin) and Tannalbin (tannin and albumen) have been recommended for diarrhœa. They may be given in 10 grain (6 decigrms.) doses in a cachet. Tannoform (tannin and formic aldehyde) is used as a dusting powder.

Acidum Pyrogallicum. Trihydroxybenzo (Not official.)

Synonym.—Pyrogallol. $C_6H_3(OH)_3$.

Source. Obtained by heat from gallic or tannic acid, b chemically it is related to phenol.

Characters.—Light, small, white crystals. Odour, non *Taste.* It produces a feeling of coldness on the tongu *Solubility.*—1 in 2½ of water; 1 in 10 of lard.

Action and Therapeutics.

It is used externally as an ointment (Jarisch's ointme is pyrogaltic acid, 60 gr., 4 grms.; lard, 1 oz., 32 grms.) for th treatment of chronic psoriasis. Jarisch's ointment is ve strong; a more usual strength is one-sixth or one-third the above. Pyrogallic acid is also an excellent parasiticid for ringworm. It must not be applied over too large surface, as it may be absorbed, and then it breaks up th blood corpuscles, causing methæmoglobinuria and jaundic It is too powerful a poison to give internally.

CATECHU.

Catechu. *Synonyms.* Pale catechu, Catechu Pal dum. An extract of the leaves and young shoots of *Uncari gambier.* Prepared at Singapore and other places in th Eastern Archipelago.

Characters.—In cubes (sometimes agglutinated), eac side 25 millimetres, deep reddish brown externally, pal brown internally; dull, earthy fracture, under the micro scope showing myriads of small acicular crystals. Odourle Taste at first astringent, bitter, then sweet. Entirely solub in boiling water.

Composition. The chief constituents are (1) *Catechu tannic acid,* 40 per cent., the active principle, isomeri with catechin, and converted into it by boiling or by th saliva, a red colour being formed. (2) Catechin or catechui acid, probably inactive. (3) Pyrocatechin or catechol, C_6H $(OH)_2$, gives a green colour with ferric chloride. Pyrocatechi is found pathologically in the urine and gives it a dark colou

Incompatibles.—Alkalies, metallic salts, and gelatin.

Impurity.—Starch.

Dose, 5 to 15 gr. - 3 to 10 decigrms.

Preparations.

1. Pulvis Catechu Compositus. Catechu, 1 : kino, 2; rhatany, 2; cinnamon, 1; nutmeg, 1. *Strength* of catechu, 4 in 10.

Dose, 10 to 60 gr. 6 to 40 decigrms.

2. Tinctura Catechu.– Catechu, 4; cinnamon, 1, alcohol (60 per cent.), 20. Macerate.

Dose, ½ to 1 fl. dr. 2 to 4 mils.

3. Trochiscus Catechu. 0·06 grm. or 1 gr. in each with a fruit basis.

Catechu Nigrum. *Synonym.* Black Catechu. An extract from the wood of *Acacia catechu.*

CHARACTERS. Irregular dark brown masses, brittle, porous, glossy fracture.

It is the only form of catechu in the pharmacopœias of all countries but Great Britain, as it has the same action as, but is much more constant and powerful than, the official pale catechu. In India, the East generally, and North America it may be used to make the preparations for which catechu is directed to be used.

Dose, 5 to 15 gr.– 3 to 10 decigrms. in powder.

ACTION AND THERAPEUTICS.

Catechu is a powerful **astringent**, acting in virtue of its tannic acid, and having a precisely similar action to it. It is used as a lozenge for sore throats, and the other preparations, especially the compound powder, are very efficacious for diarrhœa.

RHATANY.

Krameriæ Radix.– Krameria Root *Synonym.* Rhatany Root. The dried root of (1) Para Rhatany, a species of *Krameria* probably *Krameria argentea*; or of (2) Peruvian Rhatany, *Krameria triandra.*

CHARACTERS.– (1) Para.– Cylindrical pieces, purplish brown, smooth thick bark which adheres closely to the wood and has deep cracks. Wood, fracture short, colour reddish-brown. (2) Peruvian.—Dark reddish brown yellow, woody The bark separates easily, is thinner than that of Para, tly rough and scaly. The bark of both kinds is strongly astringent, and tinges the saliva red.

COMPOSITION.– The chief constituents are –(1) *Rhatanh* *tannic acid*, 20 per cent. (2) Rhatanhia red, the colour matter. (3) Rhatannin, a neutral substance.

INCOMPATIBLES – Alkalies, lime water, salts of iron a lead, and gelatin.

Preparations.

1. Extractum Krameriæ. – Aqueou

Dose, 5 to 15 gr.– 3 to 10 decigrms.

2. Infusum Krameriæ. 1 in 20 of boiling wat

Dose, $\frac{1}{2}$ to 1 fl. oz. – 15 to 30 mils.

3. Pulvis Catechu Compositus. Catechu, kino, 2; krameria, 2; cinnamon, 1; nutmeg, 1.

Dose, 10 to 60 gr. 6 to 40 decigrms.

4. Tinctura Krameriæ. Powdered krame root, 1; alcohol (60 per cent.), 5. Percolate.

Dose, $\frac{1}{2}$ to 1 fl. dr. – 2 to 4 mils.

5. Trochiscus Krameriæ.– 0·06 grm. or 1 of the extract of krameria in each with a fruit basis

6. Trochiscus Krameriæ et Cocainæ.– Extra of krameria, 0·06 grm.; cocaine hydrochloride, 0·003 gr Fruit basis. This lozenge contains 0·003 grm. or of cocaine hydrocloride.

ACTION.

The action of rhatany is due entirely to the tann acid it contains. It is therefore a powerful **astri** **gent.**

THERAPEUTICS.

The powdered extract is the important ingr dient of many tooth powders which are useful wh the gums are liable to bleed. The infusion is excellent gargle for a relaxed throat, and the lozeng are also efficacious, those of rhatany and cocaine bei specially serviceable. Bleeding from the nose or t rectum may be stopped by applying powder rhatany root locally; the infusion may be used an injection in leucorrhœa and gonorrhœa. A of the preparations, especially the compound catec owder, are powerful astringents for all varieties of iarrhœa, and may be taken to stop bleeding from he stomach and intestines. They are also given as emote hæmostatics for hæmoptysis and hæmaturia. they are not reliable for these purposes.

KINO.

Kino. The juice obtained from incisions into the trunk *Pterocarpus marsupium*, heated to boiling and evaporated dryness. Known in commerce as East Indian, Malabar, Madras, or Cochin Kino.

CHARACTERS.—Small, angular, glistening, reddish-black, ttle fragments. In thin pieces, and at the edges translucent ruby-red. Inodorous. When chewed, sticks to the teeth colours the saliva blood-red. *Solubility.*—Easily in ol (90 per cent.), also in boiling water, partially in cold.

COMPOSITION. The chief constituents are (1) *Kino-nic acid*, 75 per cent. (2) Kinoin, a crystalline neutral tance. (3) Pyrocatechin, $C_6H_4(OH)_2$ (*see* p. 592). (4) Kino , formed from kino-tannic acid by oxidation. (5) Gum.

INCOMPATIBLES. Mineral acids, alkalies, all metallic salts onates, gelatin.

Dose, 5 to 20 gr. 3 to 12 decigrms.

Preparations.

1. Pulvis Kino Compositus.—Kino, 15; opium, 1; cinnamon, 4. *Strength* of opium, 5 per cent.
Dose, 5 to 20 gr.—3 to 12 decigrms.

2. Tinctura Kino. Kino, 10; glycerin, 15; water, 25; alcohol (90 per cent.), to make 100. Macerate.
Dose, ½ to 1 fl. dr.—2 to 4 mils.

3. Pulvis Catechu Compositus. 2 in 10 (*see* p. 593).

ACTION AND THERAPEUTICS.

Kino-tannic acid acts like tannic acid, and therefore kino is a powerful astringent. It is used in astringent gargles, and also in diarrhœa mixtures.

BENGAL KINO.

Buteæ Gummi.—The inspissated juice from
cisions of the stem of *Butea frondosa*.

CHARACTERS.—Small, irregular, shining fragment
very dark ruby colour.

ACTION AND THERAPEUTICS.

Butea gum, commonly called Bengal kino,
in India and the East Indies used for the sa
purposes and to make the same preparations as
ordinary kino.

LOGWOOD.

Hæmatoxyli Lignum. Logwood. The he
wood of *Hæmatoxylon campechianum*. Campeachy, Hondu
and Jamaica.

CHARACTERS. The logs, in which form it is imported,
hard, heavy, orange or purple red externally, and intern
reddish brown. The chips are reddish brown. Odour agreea
peculiar. Taste sweetish, astringent. When chewed the sal
is coloured reddish pink. *Resembling logwood.* Red sand
wood, which is more dense and less astringent.

COMPOSITION. The chief constituents are (1) *Tan
acid.* (2) Hæmatoxylin, $C_{16}H_{14}O_6$, 12 per cent. Occur
in colourless crystals, which become dark red on exposur
light and air. Solutions of it are used to stain histolog
specimens.

INCOMPATIBLES.—Mineral acids, lime water, and ta
emetic; metallic salts give a blue colour.

Preparation.

Decoctum Hæmatoxyli.—Logwood, 50;
namon bark, 10; water, to 1000.

Dose, ½ to 2 fl. oz.—15 to 60 mils.

ACTION AND THERAPEUTICS.

In virtue of its tannic acid logwood is a power
astringent, and for this purpose is used to cont
diarrhœa of all sorts. It may be combined w
other astringents, as chalk and opium. It does

sily produce constipation. It colours the urin l fæces dark red. One disadvantage of it is that stains linen if dropped on it.

HAMAMELIS.

Hamamelidis Cortex. The dried bark of *amelis virginiana*, the witch-hazel. United State *m.*—Witch hazel bark.

CHARACTERS. Curved pieces ½ to 2 decimetres long, 1½ metres thick. Scaly, silver-grey outer bark marked with , but often free from outer bark and then smooth h brown. Interior bright brownish red, striated tudinally. Taste astringent.

COMPOSITION. The chief constituents are (1) *Tannic* 8 per cent. (2) A volatile principle not yet isolated (3) A little colouring matter.

Preparation.

Tinctura Hamamelidis. Hamamelis bark, 1 alcohol (45 per cent.), 10. Percolate

Dose, ½ to 1 fl. dr. 2 to 4 mils.

Hamamelidis Folia. The fresh or dried leave *Hamamelis virginiana*.

CHARACTERS. 7 to 15 centimetres long, 3 to 4 in. broad apex obtuse, oblique at the base, dark brown green above, low. Veins prominent. Odour slightly tea like. Taste ngent, bitter.

COMPOSITION. The same as of the bark, but the leaves tain rather less tannin. The fresh are more active than dried.

Preparations.

1. Extractum Hamamelidis Liquidum.—Hamamelis leaves, powdered, 1000, percolated with alcohol (45 per cent.), 1000.

Dose, 5 to 15 m.—3 to 10 decimils.

2. Liquor Hamamelidis. Fresh leaves, 100; water, 200; alcohol (90 per cent.), 16. Macerate and distil.

3. Unguentum Hamamelidis. The liquid extract, 1; wool fat, 6; soft paraffin, 3.

Action and Therapeutics.

Hamamelis is, because of its tannic acid, **astr**
gent and **hæmostatic**. The liquid extract or
tincture is used for capillary hæmorrhage fr
wounds, for bleeding from the nose, the sockets
the teeth, the gums, or from piles, and either m
be injected into the bladder in vesical hæmorrha
For all these purposes they are diluted with wat
the fluid may be any strength; 1 of the tinctur
10 or 20 of water is commonly employed. Loca
applied, hamamelis, either as the ointment or a dil
fluid preparation, such as the liquor, is used as
astringent in bruises, sprains, pharyngitis, and n
catarrh. The ointment is often used for piles. Gi
by the mouth, hamamelis may check diarrh
and dysentery; and it is reputed to be a rem
hæmostatic and astringent, but this is probably
correct. Hazeline is a distilled extract from the lea

EUCALYPTUS KINO.

Kino Eucalypti. *Synonyms.* Eucalyptus
(B. P. 1898), red gum. An exudation from the stem
various species of *Eucalyptus*. Australia.

Characters. Dark reddish-brown grains or small mas
Tough. Adheres to the teeth when chewed. Taste astring
Soluble in water. *Resembling eucalyptus kino.*— Kino, wh
darker and feebly soluble in water.

Composition. The chief constituents are (1) *K*
tannic acid. (2) Catechin. (3) Pyrocatechin (*see* p. 592

Dose, 5 to 20 gr.—3 to 12 decigrms.

Preparation.

Trochiscus Kino Eucalypti.—0·06 grm. or
in each with a fruit basis.

Action and Therapeutics.

Eucalyptus gum is, in virtue of its tannic a
powerfully **astringent**, and is used for diarrhœa
dysentery. The lozenges, or a decoction of 1 in

gargle, are employed for relaxed throats. This decoction may also be given in doses of 2 to 4 fl. dr. (8 to 16 mils) for diarrhœa. A liquid extract (red gum, 7 : water, 21 ; alcohol [90 per cent.], 1 : dose, ½ to 1 fl. dr., 2 to 4 mils) is a useful preparation. Injected into the nose it stops epistaxis. Mixed with 1 in 10 of water it may be injected into the rectum or vagina, or may be used as a mouth wash. Suppositories, each containing 5 gr. (3 dcgrms.) of red gum, are prepared, and may be employed for piles.

ACACIA BARK.

Acaciæ Cortex. The dried bark of *Acacia arabica* or *Acacia decurrens*, obtained from wild or cultivated trees not less than seven years old, and, after being dried, kept one year before use.

CHARACTERS.—Hard, brown, the inner surface red. Taste astringent.

Imported chiefly from India, Australian Colonies, Eastern [illegible]

Preparation.

Decoctum Acaciæ Corticis.—Bark 60 grms., water 1000 millilitres.

Dose, ½ to 2 fl. oz.—15 to 60 mils.

ACTION AND THERAPEUTICS.

This bark contains much tannin, and is therefore powerfully astringent, being used especially as a gargle and mouth-wash, and for vaginal discharges. It is used in tanning.

BAEL FRUIT.

Belæ Fructus. The fresh half ripe fruit of *Ægle Marmelos*.

CHARACTERS.—Seven or eight centimetres in diameter, globular, smooth. Ten to fifteen cells, each containing woolly seeds. Pulp juicy, drying an orange red colour.

Preparation.

Extractum Belæ Liquidum. Bael frui
chloroform water, 150; evaporate to 75 an
alcohol (90 per cent.) to produce 100.
Dose, 1 to 2 fl. dr.—**4 to 8 mils.**

ACTION AND THERAPEUTICS.

As imported into England bael fruit is use
it is therefore rarely employed out of India, w
the extract of the fresh fruit is used for the t
ment of diarrhœa and dysentery. It contai
little tannin, and its mode of action is not know

MYROBALANS.

Myrobalanum. *Synonym.* Chebulic myrob
The dried immature fruits of *Terminalia chebula.*

CHARACTERS.—Ovoid or fusiform; 10 to 30 millim
long, 5 to 15 millimetres wide; shrivelled longitudin
black, solid, brittle. Taste very astringent.

Dose, 30 to 60 grs.—**2 to 4 grms.**—in powder.

Preparations.

1. Unguentum Myrobalani.—Myrobalan
benzoated lard, 4. In India benzoated suet shou
used instead of benzoated lard.

2. Unguentum Myrobalani cum Op
Myrobalan ointment, 925; opium in powder
Strength.—7·5 per cent. of opium.

ACTION AND THERAPEUTICS.

These fruits contain from 25 to 45 per cen
tannin, and they may be used for the same purp
as other bodies which contain tannin. They
used chiefly in India and the East Indies. The f
fruit is aperient and is often used for this propert

GROUP IX.

Vegetable Demulcent Substances.

Many of these are nutritive.

Olive Oil, Arachis Oil, Sesame Oil, Soap, Glycerin, Oleic Acid, Almonds, Tragacanth, Gum Acacia, Indian Gum, Liquorice, Linseed, Spogel Seeds, Sugar, Malt, Soya Beans.

OLIVE OIL.

Oleum Olivæ. The oil expressed from the ripe fruit of *Olea europæa*, and refined. South Europe.

Characters. A pale yellow or greenish yellow fluid. Odour faint. Taste oleaginous. Sp. gr. 0·915-0·918.

Composition.—The two constituents are—(1) *Olein*, 72 per cent., a fluid oil, a compound of oleic acid and glyceryl, olein: $C_3H_5(C_{18}H_{33}O_2)_3$. (2) *Palmitin*, nearly 28 per cent., a solid oil, a compound of palmitic acid and glyceryl, $C_3H_5(C_{16}H_{31}O_2)_3$. The formula for oleic acid is $C_{18}H_{34}O_2$; and for palmitic, $C_{16}H_{32}O_2$. Olive oil is much adulterated, especially with sesame oil and cotton-seed oil.

Olive oil is contained in many plasters, ointments, and liniments. From it are made hard soap, soft soap, and glycerin.

Action and Therapeutics.

External.—Olive oil is used to facilitate the rubbing of parts; for this purpose it is employed in massage. It is a common soothing protective to burns (see Linimentum Calcis, p. 162), and may be mixed with poultices to prevent their sticking to the skin. If rubbed in vigorously, it can be absorbed through the epidermis, and might be thus used as a food when nourishment cannot be given by the mouth.

Internal.—For its soothing protective qualities it may be swallowed after corrosive poisons have been taken. All fats retard gastric and accelerate pancreatic secretion. Because olive oil retards the flow of the

gastric juice it is an excellent food in cases of g
ulcer, for the acid prevents the healing of the u
It is a good mild laxative, and can be given
food for this purpose. Some persons like it, with o
it excites nausea and vomiting. An olive oil e
(warm olive oil, 5 fl. oz.—150 mils; with or wi
warm mucilage of starch, 8 fl. oz.—240 mils) is
used to open the bowels when a mild non-irrit
injection is required.

A gall-stone placed in pure olive oil at the
perature of the body is slowly dissolved, be
cholesterin, which is the chief constituent of
stones, is soluble in olive oil. It is also soluble in
acid and in animal soaps. Many patients suff
from gall-stones derive much benefit from taking
oil. Possibly this is because the oil or some
constituents are excreted by the bile, and to a
less extent because the intestinal peristalsis se
by the olive oil extends to the bile ducts.
2 to 8 fl. oz (60 to 240 mils) should be taken
It may be mashed with fish or potato. Some p
take it better if a few grains of menthol a
drachm (4 mils) of brandy are added to each 8
(240 mils) of oil. If it disagrees, oleic acid
may be tried. Eunatrol, consisting of 70 per
of sodium oleate with 30 per cent. of oleic acid
been successfully used in cases of gall-stones. T
to forty-five grains (2 to 3 grms.) may be given
day. It is best prescribed as pills.

Olive oil is a food, and is the best means of g
food subcutaneously; 15 c.c. of sterilized oil m
injected under the skin twice a day. This y
about 280 calories, and is an aid to rectal fee
(*see* p. 616).

ARACHIS OIL.

Oleum Arachis. *Synonyms.*—Earth-nut
ground-nut oil, pea-nut oil. The oil expressed without
m the seeds of *Arachis hypogæa.*

s of gastric
the ulcers
given with
with others
oil enema
or without
ls) is often
n-irritating

at the tem-
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nt of gall-
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me people
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ch 8 fl. oz.
acid (*q.v.*
per cent.
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n-nut o...
ithout heat

CHARACTERS.—Pale yellow or greenish yellow; nut-like odour. Sp. gr. 0·916 to 0·921.

USES.

Used in India, African Colonies, Eastern Colonies, and Australasian Colonies, instead of olive oil, to make liniments, ointments, and plasters.

SESAME OIL.

Oleum Sesami.—The oil expressed from the seeds of *Sesamum indicum.*

CHARACTERS.—A limpid oil of a pale yellow colour, a faint odour, and a bland taste. Sp. gr. 0·921 to 0·924.

USES.

Used in India, African Colonies, Eastern Colonies, and North American Colonies, instead of olive oil, to make liniments, ointments, and plasters.

SOAP.

Sapo Durus. Hard soap. It is sodium oleate, $NaC_{18}H_{33}O_2$, containing 30 per cent. of water. It is rarely pure, almost always containing some alkaline hydroxide or carbonate.

SOURCE.—Made by acting on olive oil with caustic soda. $C_3H_5(C_{18}H_{33}O_2)_3 + 3NaHO = 3NaC_{18}H_{33}O_2$ (hard soap) + $C_3H_5(OH)_3$ (glycerin).

Preparations.

1. **Emplastrum Saponis.**—Hard soap, 140; lead plaster, 835; resin, 25.

2. **Pilula Saponis Composita.** Opium, 1; hard soap, 3; syrup of glucose, 1. *Strength of Opium*, 20 per cent.

Dose, 2 to 4 gr.—12 to 25 centigrms.

Hard soap is used to make many pills.

Sapo Mollis. Soft Soap. It is potassium o $KC_{18}H_{33}O_2$. It is rarely pure, almost always containing alkaline hydroxide or carbonate.

SOURCE. Made by acting on olive oil with caustic po $C_3H_5(C_{18}H_{33}O_2)_3 + 3KHO = 3KC_{18}H_{33}O_2 + C_3H_5(OH)_3$ (glycer

Preparation.

Linimentum Saponis. *Synonym.* Opode Soft soap, 80; camphor, 40; oil of rosemary, water, 170; alcohol (90 per cent.), to 1000.

Soft soap is contained in Linimentum Terebinthinæ. *Linimentum Saponis is contained in* Linimentum O For Sapo Animalis *see* p. 661.

USES.

Hard soap, like curd soap, may be used medicated soaps. The prescriber should state percentage of the drug, *e.g.* ichthyol, tar, sulph he wishes the soap to contain. The dispen planes the hard or curd soap into thin shavin dries them at 38°C., powders them in a mor then thoroughly mixes and beats up the soap powd the drugs, and 1 part of alcohol (60 per cent.) to 8 pa of soap powder. The whole is put into a s press and stamped.

Hard soap forms a basis for many pills and the plaster of it. Soft soap is a basis for the linim of it. Either variety is frequently made into a lat with about a pint of water at 38°C. and used a purgative enema. Soft soap is much to be preferre about 1 fl. oz. (30 mils) is commonly used. enemata, but perhaps especially those made w hard soap, may produce an erythematous ra probably due to the solution and consequent abso tion of some fæcal toxin.

GLYCERIN.

Glycerinum. Glycerin. $C_3H_5(OH)_3$. *Synonym.*—Glycerol. It is a trihydric alcohol. It is always associated with a little water.

SOURCE. It is obtained by hydrolysis by the interaction of alkalies or of superheated steam with fats and fixed oils (*se* pp. 4 and 604).

CHARACTERS.—These are well known. It is miscible with water and alcohol. Its sp. gr. is 1·26. It is formed in the making of lead plaster (*see* p. 170).

Dose, 1 to 2 fl. dr.—4 to 8 mils.

Preparations.

1. **Glycerinum Acidi Borici.** *Synonym.* Boroglyceride. Powdered boric acid, 3; glycerin, 10; heat gently. It is a 30 per cent. solution.

2. **Glycerinum Acidi Carbolici.** Carbolic acid, 1; glycerin, 5.

3. **Glycerinum Acidi Tannici.** Tannic acid, 1; glycerin, 5.

4. **Glycerinum Aluminis.** Purified alum, 20; glycerin, 120; distilled water, 7·5; heat gently if necessary.

5. **Glycerinum Amyli.**—Starch, 2; glycerin, 13; water, 3; heat to form a jelly.

6. **Glycerinum Boracis.**—Borax, 1; glycerin, 6.

7. **Glycerinum Pepsini**—Pepsin, 100; hydrochloric acid, 11·5; glycerin, 600; distilled water to 1000. *Strength*, 1 fl. dr. contains about 5·5 gr. of pepsin; 10 mils contain 1 grm.

Dose, 1 to 2 fl. dr.—4 to 8 mils.

8. **Glycerinum Plumbi Subacetatis.** Stron solution of lead acetate, 5; glycerin, 5; water, q Sp. gr. 1·48.

9. **Glycerinum Tragacanthæ.**—Tragacanth, 1; glycerin, 3; water, 1.

10. **Suppositoria Glycerini.**—Gelatin, 14; glycerin, 70; water, to make 100; each suppository contains 70 per cent. of glycerin. They must be kept wrapped in waxed paper, as they absorb moisture.

Glycerin is also contained in Linimentum Potassi
oum Sapone, in Mel Boracis, in all Lamellæ, in Ex
Cinchonæ Liquidum, Pilula Quininæ Sulphatis, Syrupu
Virginianæ, Lotio Hydrargyri Nigra, Liquor Ethyl
Tinctura Rhei Composita, Tinctura Cardamomi Con
Tinctura Kino, Tinctura Chloroformi et Morphinæ Con
Confectio Sulphuris, and in Unguentum Iodi.

ACTION.

External.—As glycerin is an excellent s
for numerous bodies, such as iodine, bromine, al
tannic acid, many neutral salts, alkaloids, and s
it is a good vehicle for applying these substan
the skin and to sores. It does not evaporate no
rancid, and is powerfully hygroscopic.

Internal.—In man the only visible effec
duced by its administration is **purging**. This
with quite small doses if it is given by the re
but large doses are necessary if given by the m
It is absorbed from the alimentary canal, and
a slight extent a food, for some of it is oxidiz
the body. Sometimes its administration le
the appearance in the urine of a body which re
cupric oxide and gives the fermentation te
sugar. There has been much dispute as to wh
glycerin can control nitrogenous metabolism
it appears that it cannot in any way save the
of nitrogenous tissues. It probably has some
ence on the amount of glycogen in the live
has also been thought to prevent artificial glyco
but this is doubtful.

Very large doses in animals cause the urine
dark from the presence of the colouring matt
the blood, although there are no corpuscles i
they also lead to loss of muscular strength, leth
dryness of mucous membranes, collapse,
death.

THERAPEUTICS.

External.—Glycerin is much employed as a basis for applications to the skin and the eye. It is commonly used for chapped hands and slight excoriations. It is readily absorbed when rubbed into the skin, therefore it is a convenient vehicle for the absorption of substances by the skin. Belladonna mixed with glycerin is often rubbed in when we desire its local anodyne action (*see* p. 391).

Internal. As glycerin is sweet it is an excellent flavouring agent. It is demulcent, and is used as a vehicle for applying substances, such as tannic acid, to the throat. Glycerin is rarely given by the mouth for any medicinal virtue. It has been administered for dyspepsia, for diabetes, and as a nutritive agent, but probably in each case without much good. One to two fluid drachms injected up the rectum, or a glycerin suppository, form an excellent means of opening the bowels in simple constipation, especially when the fæces are in the sigmoid flexure and rectum. The result is prompt, often occurring within less than half an hour. No pain or constitutional disturbance is produced.

OLEIC ACID.

Acidum Oleicum.

SOURCE. Made by the saponifying action of alkalies and subsequent action of acids, or by the action of superheated steam, upon commercial oleins.

CHARACTERS. A straw-coloured oily liquid, nearly odourless and tasteless, very faintly acid. By exposure it darkens in colour and becomes rancid. It becomes semi-solid at 40°F. Sp. gr. 0·89 to 0·91. *Solubility.* Not in water. Easily in alcohol, chloroform, and ether.

IMPURITIES. It is rarely pure, usually containing stearic and palmitic acids.

Oleic acid is contained in Unguentum Atropinæ, in Unguentum Aconitinæ, and Unguentum Cocainæ.

'otassii Iodid
in Extractun
Syrupus Prun
Ethyl Nitritis.
ii Composita.
æ Composita.

ent solvent
ne, alkalies,
and salicin.
bstances to
te nor turn

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he rectum.
the mouth.
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glycosuria.

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cles in it:
, lethargy,
apse, and

Lead plaster contains oleate of lead, and *Zinc o*
ointment contains oleate of zinc.

Hydrargyri Oleas is official.

ACTION AND THERAPEUTICS.

Oleic acid is used as a solvent for remedies wh
it is desired to apply by means of cutaneous inu
tion, for it more readily penetrates the skin t
fats and oils. It is particularly useful as it
dissolve most metallic oxides and all alkaloids (
not their salts), forming oleates dissolved in
excess of oleic acid. Hence its employment in
official preparations mentioned above. Oleate
copper is also used for ringworm and indolent so
Oleic acid is given internally in capsules (7½
50 centimils, in each) for gallstones. Two or th
daily, best on an empty stomach. It acts like ol
oil (*see* p. 601).

ALMONDS.

Amygdala Dulcis. Sweet Almond. *Synonym*
Jordan almond. The ripe seed of *Prunus amygdalus*, v
dulcis.

CHARACTERS.—About 2½ centimetres long; oblong, ac
at one end, rounded at the other, flattened; brown, sligh
rough exterior. Taste sweet and nutty.

COMPOSITION. The chief constituents are (1) *Olet*
Amygdalæ (*see* p. 609), 50 per cent., the same fixed oil as
bitter almonds. (2) Emulsin and other albuminous bodie

IMPURITY. The bitter almond, giving an odour of prus
acid when rubbed with water.

Preparations.

1. **Pulvis Amygdalæ Compositus.** — Sw
almonds, 6; sugar, 3; gum acacia, 1.

2. **Mistura Amygdalæ.**—Compound almo
powder, 125; water, 1000.

Dose, ½ to 1 fl. oz.—15 to 30 mils.

Amygdala Amara.—Bitter Almond. The ripe seed of *Prunus amygdalus*, var. *amara*.

CHARACTERS.—Like the sweet almond, but broader and shorter, with a bitter taste.

COMPOSITION.—The chief constituents are—(1) *Oleum Amygdalæ* (*see below*), 50 per cent. (2) *Emulsin.* (3) *Amygdalin*, $C_{20}H_{27}NO_{11}$, a crystalline soluble glucoside which, on mixing with water, is hydrolysed by the enzyme, emulsin, and yields glucose, prussic acid, and (*Oleum Amygdalæ Amaræ* (*synonyms* Essential oil of bitter almonds, benzaldehyde) (not official). Thus $C_{20}H_{27}NO_{11} + 2H_2O = C_6H_5COH$ (the essential oil) $+ HCN + 2C_6H_{12}O_6$. The oil itself is not poisonous, and is used to flavour sweets; nitro-benzol used to be often substituted, and has caused death. The essential oil usually has some prussic acid associated with it, and this form may be used for external application, but for internal use the oil without prussic acid should be ordered.

Oleum Amygdalæ.

SOURCE.—The fixed oil obtained by expression from either sweet or bitter almonds.

CHARACTERS.—Pale yellow, nearly inodorous, with an oleaginous, nutty taste. *Solubility.* Slightly in alcohol, easily in ether or chloroform. Sp. gr. 0·915 to 0·920. It is commonly adulterated with peach-kernel oil.

Almond oil is contained in Linimentum Ammoniæ, Oleum Phosphoratum, and Unguentum Aquæ Rosæ, as it makes a whiter ointment than olive oil.

ACTION AND THERAPEUTICS.

The sweet almond is demulcent. Its most important medicinal use is that it is made into flour to replace starchy food in cases of diabetes. Biscuits are made of the flour. These are very palatable, are a good nutritive food, and contain very little starch. The only objection to them is their price. With a little care they can be made at home. The flour of other nuts, as Brazil nuts, has been used, but it is not nearly so palatable.

The almond mixture is a very pleasant vehicle

for the suspension of insoluble substances, an
powder is a palatable basis for powders.

Oleum Amygdalæ might be used for the same
poses as olive oil. It is pleasanter, but very expe

TRAGACANTH.

Tragacantha. A gummy exudation obtain
incision from *Astragalus gummifer* and other spec
Astragalus. Known in commerce as Syrian Traga
From Asia Minor.

Characters.—In white or yellowish, thin flak
varying size or shape, marked with concentric ridges,
what translucent, tough, but more pulverizable at a tem
ture of 49° C. Odourless and almost tasteless. Spa
soluble in cold water, but swells into a gelatinous mass,
is tinged violet (not so deep as the colour given by star
tincture of iodine. *Resembling tragacanth.*—Scilla, wh
thicker and opaque.

Impurities.—Other gums.

Composition.—The chief constituents are—(1) *T*
canthin (said to be identical with Bassorin), a gum, $C_{12}H$
33 per cent., only slightly soluble in water, unferment
(2) An *Arabin*-like gum, 53 per cent., soluble in water,
like the arabin of acacia, but it is precipitated by lead ac
or ferric chloride. (3) A little starch.

Preparations.

1. Glycerinum Tragacanthæ. Tragacant
glycerin, 3; water, 1.

2. Mucilago Tragacanthæ.—Tragacanth,
alcohol (90 per cent.), 2·5; water, 100.

3. Pulvis Tragacanthæ Compositus.—Tr
canth, 15; gum acacia, 20; starch, 20; sugar, 45
Dose, 10 to 60 gr. 6 to 40 decigrms.

Tragacanth is contained in Confectio Sulphuris, Mis
Cretæ, Mistura Guaiaci, Pilula Ferri, Pilula Hydrargyri
chloridi Co., Pilula Quininæ Sulphatis, and Pulvis
Compositus.

Action and Therapeutics.

Tragacanth is a demulcent, and as such may
soothing when applied to a sore throat. Its c

is to suspend insoluble bodies, as resins, oils, and insoluble powders. The mucilage is better for this purpose than the compound powder, which, because of its starch, is liable to ferment.

GUM ACACIA.

Acaciæ Gummi. A gummy exudation from the stem and branches of *Acacia Senegal*, and from other species of *Acacia*. Kordofan.

CHARACTERS.—Round or ovoid tears or masses. Colourless, or with a yellowish-brown tint. The tears are either opaque from numerous minute fissures and brittle, or they are glistening, transparent, and difficult to break. No odour. Taste bland, mucilaginous. *Solubility.*—Freely in water, not in alcohol.

COMPOSITION.—The chief constituent is *arabin*, or *arabic acid*, $C_6H_{10}O_5$; most of it is combined with calcium, but some with magnesium and potassium. It is unaffected by lead acetate.

IMPURITIES.—Starch, gum-resins.

INCOMPATIBLES.—Alcohol, sulphuric acid, borax, per-salts of iron, and lead subacetate.

Preparation.

Mucilago Acaciæ. Gum acacia, 10; water, 15. Should be recently prepared.

ACTION AND THERAPEUTICS.

Gum acacia is demulcent. It is used to suspend insoluble substances, as oils, resins, and insoluble powders. A fluid ounce of most oils or resinous tinctures requires 3 fl. dr. (12 mils) of mucilage of acacia for suspension, but copaiba requires 10 fl. dr. (40 mils). A disadvantage of it is that it is liable to undergo acetous fermentation, which greatly diminishes its emulsifying power. This may to some extent be overcome by making it with tolu water or clove water. It may give rise to indigestion and diarrhœa.

INDIAN GUM.

Gummi Indicum. A gummy exudation fr
wood of *Anogeissus latifolia.*

Characters. Rounded pale amber translucent tes

Preparation.

Mucilago Gummi Indici. Indian Gu
water, 15.

Action and Therapeutics.

Indian gum is used in India and the East
for the same purposes as gum acacia.

LIQUORICE.

Glycyrrhizæ Radix. Liquorice Root. The
root and peeled subterranean stems of *Glycyrrhiza*
and other species. Cultivated in Britain.

Characters. Long cylindrical pieces; before
peeled dark brown and longitudinally wrinkled, when
yellow, fibrous. Fracture fibrous. Faint odour. When
taste sweet and mucilaginous, slightly acid when
Resembling liquorice.—Pyrethrum and Taraxacum, whi
not sweet.

Composition. The chief constituents are—(1) *G*
rhizin, a yellow amorphous glucoside, $C_{24}H_{36}O_{9}$, proba
combination with ammonia. With acids this yields a
bitter substance, glycyrrhetin, and glucose. (2) Aspa
(3) Grape sugar, resin, starch, gum, and malic acid.

Preparations.

1. Extractum Glycyrrhizæ. Liquorice
1; chloroform water, 5.

2. Extractum Glycyrrhizæ Liquidu
Liquorice root, 1; chloroform water, 5; alcoho
per cent.), q.s.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

3. Pulvis Glycyrrhizæ Compositus.—S
16; liquorice root, 16; fennel, 8; sublimed sulphu
sugar, 52.

Dose, 60 to 120 gr.—4 to 8 grms.

Liquorice or its preparations are contained in many preparations, generally to cover their nauseous taste. They hide very well that of aloes, cascara sagrada, ammonium chloride, hyoscyamus, senega, senna, turpentine, and very bitter substances.

ACTION AND THERAPEUTICS.

Liquorice is an excellent demulcent for sore throats. It is used to hide the taste of nasty medicines, and as a basis for pills. The compound liquorice powder is laxative in virtue of its senna and sulphur.

LINSEED.

Lini Semina. Linseed (called Linum B. P. 1898). The dried ripe seeds of *Linum usitatissimum*, flax. Cultivated in Britain.

CHARACTERS.—Small, flat, oval, pointed, with acute edges; brown, smooth, shining externally, yellowish white within; odourless; testa mucilaginous.

COMPOSITION.—The covering contains much mucilage; the interior contains 30 per cent. of the fixed oil (*see below*).

Lini Semina Contusa.—Crushed Linseed (called Linum Contusum B. P. 1898). *Synonym.*—Linseed meal. Linseed reduced to powder. It should be recently prepared.

Oleum Lini.—Linseed Oil.

SOURCE.—Expressed from linseed.

CHARACTERS.—It is viscid, yellow fixed oil, of sp. gr. 0·930 to 0·940. It is commonly called "drying oil" because it oxidates with oxygen and becomes resinoid on exposure, the linoleic acid in it becoming oxylinoleic acid.

COMPOSITION.—It consists of a compound of glyceryl with linoleic acid together with small quantities of palmitin and myristin.

ACTION AND THERAPEUTICS.

A linseed poultice (mix gradually 4 parts of crushed linseed with 10 of boiling water, stirring all the while. Do it before the fire, and heat the basin first so that the poultice may be as warm as possible) is a very common means of applying warmth and moisture to a part. It is used to relieve pain, and as a mild irritant to accelerate inflammation and the bursting of an abscess, or as a counter-irritant in all sorts of deep-seated inflammations. The poultices should not be too thick, and should be smeared with oil to prevent their sticking to the skin. The vascular dilatation caused by a linseed poultice may be increased by adding 1 part of mustard to 16 of linseed. A layer of linseed meal may be placed on the powdered ice of an ice poultice (*see* p. 126), to absorb the water and to prevent the lumps of ice from hurting the skin. The ice poultice may be made in between sheets of thin gutta-percha, and the edges stuck together by being moistened with chloroform.

Linseed oil is applied to burns. Mixed with an equal quantity of lime water it forms carron oil, which is a substitute for Linimentum Calcis.

Linseed tea (linseed, 150 gr., 10 grms.; liquorice, 50 gr., 3 grms.; boiling water, 10 fl. oz., 300 mils: infuse for two hours) is a common domestic demulcent; the large quantity of mucilage it contains forms a coating for the pharynx and mouth, and thus relieves cough due to sore throat. It is said to be slightly diuretic.

SPOGEL SEEDS.

Ispaghula. *Synonym.*—Spogel Seeds. The dried seeds of *Plantago ovata.*

CHARACTERS. Boat-shaped, about 2 to 3 millimetres long and half as wide. Pale greyish-brown, with a dark spot on the convex side.

Dose, 45 to 150 gr.—3 to 10 grms. in powder.

Preparation.

Decoctum Ispaghulæ.—15 grms. of seeds to 1000 millilitres of water.

Dose, ½ to 2 fl. oz. 15 to 60 mils.

ACTION AND THERAPEUTICS.

These seeds contain much mucilage, and are used in India and the East for the same purposes as linseed. For use externally a poultice may be made from them, and internally the decoction is an excellent demulcent for sore throat, and is often given as a cool demulcent drink in diarrhœa. It is frequently given to children.

SUGAR.

Saccharum Purificatum.—Refined Sugar. *Synonyms.*—Cane sugar, Sucrose. $C_{12}H_{22}O_{11}$.

Preparations.

1. Syrupus.—Refined sugar, 10; dissolved in water, 15, with the aid of heat. Sp. gr. 1·330.

2. Syrupus Glucosi.—Syrup, 2; glucose, 1.

ACTION AND THERAPEUTICS.

Sugar is used as a sweetening agent, and in Liquor Calcis Saccharatus it increases the solubility of the lime. Syrupus Glucosi is used in pharmacy, especially in the making of pills, as it forms a neutral basis.

GLUCOSE.

Glucosum.—Glucose is a mixture of dextrose, $C_6H_{12}O_6$, and other analogous substances, and is obtained by the hydrolysis of starch.

CHARACTERS.—A very viscous syrup, almost colourless. No odour. Taste sweet. Freely soluble in water.

Preparation.

Syrupus Glucosi. Glucose, 1; syrup, 2.

ACTION AND THERAPEUTICS.

Tubes containing such an amount of glucose that, when added to a pint of sterilized water, a 6 per cent. (isotonic with the blood) solution is formed, are sold. Such a solution, transfused into the subcutaneous tissue, may be used for artificial feeding as a preliminary to and after severe operations (*see also* p. 602). Sugar is better absorbed from the rectum than any other food. The best method of rectal feeding is to give 6 per cent. dextrose solutio in tap water (510 grains to 1 pint) every six hour If the patient can at each injection retain as much a 15 fl. oz., this equals 100 grm. dextrose, which is 41 calories a day. Sometimes stronger solutions may b tolerated but usually anything above the 6 per cent. iso tonic solution is not retained easily. It is a commo error to give the dextrose in normal saline, this i absorbed with difficulty, being hypertonic. Dextrose alternated with bicarbonate of soda, by the rectum is the best treatment for acidosis not due to diabetes

Laevulose. (Not official.) $C_6H_{12}O_6$. Sufferers from diabetes can sometimes take this without harm when they cannot tolerate any other carbohydrate.

Malt. (Not official.) *Synonym.* Byne. The seed o common barley, *Hordeum distichum*, caused to enter the incipient stage of germination by heat and then dried. I contains the ferment diastase, which can convert starch into dextrin and finally to maltose. Thus $(C_6H_{10}O_5)_n$ starch + nH_2O = $nC_{12}H_{22}O_{11}$ maltose.

Extractum Malti. Extract of Malt. (Not official.) *Synonyms.* Extractum Bynes, Maltine. A liquid of the density of honey.

SOURCE. It is prepared in many ways from malt, but the basis of them all is that malt is macerated with water at about 52° C. to 72° C., and evaporated to the consistency of a thick extract. Sometimes cold water is added and the mixture is heated to between 52° and 72° C., or the warm water may be added at once. The maceration lasts several hours. Sometimes the extract is then boiled to destroy the diastasic ferment, for then it keeps better, but it loses a valuable constituent. Manufacturers often mix flour with the malt. The evaporation may be conducted *in vacuo*, and in some specimens the maltose has undergone some alcoholic fermentation; any quantity from a trace to 10 per cent. of alcohol may be present

COMPOSITION. This varies very much. The chief constituent is *maltose*, $C_{12}H_{22}O_{11}$; there is also some dextrin, $(C_6H_{10}O_5)n$, some diastase (unless destroyed by boiling), albumens, the salts of barley, and sometimes alcohol.

CHARACTERS. A sweet, thick, brownish liquid, like honey. Good specimens can by their diastase convert starch into maltose. It forms an emulsion with oils.

Dose, 1 to 4 fl. dr. 4 to 15 mils.

ACTION AND THERAPEUTICS.

Maltose is a very valuable food, especially for persons who are suffering from wasting diseases, and have a feeble digestion. It is easily tolerated by the stomach, even when, as is often the case in phthisis, other food, especially cod-liver oil, is rejected. In such a case a malt extract is an excellent substitute for cod-liver oil. Maltose leads to the formation of fat, and, like any carbohydrate, saves the protein tissues in fever. The fevered patient may take as much maltine as he can without upsetting his digestion. The diastase contained in malt extract acting upon the starch in farinaceous food converts it into dextrin and maltose, and thus, if the secretion of saliva and pancreatic juice is feeble, the extract to some extent supplies their place. Like the ferments in pancreatic juice and saliva, diastase can only act in an alkaline medium, and therefore extract of malt should not be given till at least two hours after a meal. Emulsions of cod-liver oil in it are frequently useful. Bynol is an example of these. They should contain 20 per cent. of cod-liver oil to 80 per cent. of maltine. A mixture of extract of malt and iron is also valuable (iron pyrophosphate, 2 parts; water, 3 parts; dissolve and add extract of malt, 95 parts. Mix. Dose, 1 to 4 fl. dr., 4 to 15 mils). This is Extractum Malti Ferratum, B. P. C., and there are in the market numerous preparations of extract of malt with formates, glycerophosphates, hypophosphites, quinine, strychnine, and pepsin.

Soya Beans.—(Not official.)

The beans of *Soya hispida*. These are powdered and made into a flour, from which bread and biscuits are prepared. The flour contains very little starch or sugar, sometimes not more than 2 or 4 per cent.

Bread and biscuits made from the flour are used in the treatment of diabetes as a substitute for gluten bread; they are sometimes as efficacious in reducing the sugar passed in the urine, and many patients prefer the taste

GROUP X.

Vegetable Drugs which are used to kill Parasites

CLASS I.—*Anthelmintics* for the various species of *Tap* *worm*.

Male Fern, Pelletierine Tannate, Cusso.

CLASS II.—*Anthelmintic* for the *Roundworm* (*Asca* *lumbricoides*).

Santonin.

CLASS III.—*Anthelmintics* for the *Threadworm* (*Oxyur* *vermicularis*). These are described under the head bitters (*see* page 578).

CLASS IV.—*Parasiticides* used for pediculi.

Stavesacre.

CLASS I.—**Anthelmintics used for Tapeworms.**

MALE FERN.

Filix Mas.—Male Fern. The rhizome of *Dryopter* *Filix-mas*, collected late in autumn; divested of its leave roots, and all dead portions, and carefully dried. Shoul not be kept more than one year.

CHARACTERS.—7 to 15 centimetres or more long. Th rhizome about 2 centimetres in diameter, entirely covered b the curved, angular, dark brown bases of the petioles whic bear membranous scales; brown externally, yellowish whit or brownish within. Odour feeble, disagreeable. Tast sweetish and astringent at first, subsequently bitter an nauseous.

COMPOSITION.—The chief constituents are—(1) *Filici* an amorphous body, which on exposure to air become crystalline, the active principle. (2) Aspidin. (3) Resins (4) A fixed and a volatile oil.

Preparation.

Extractum Filicis Liquidum. *Synonym.*—Oil of male fern. Male fern is percolated with ethe which is then evaporated, and an oily liquid is left which is really an oleoresin.

Must contain not less than 20 grms. of filicin in 100 grms. of the liquid extract.

Dose, 45 to 90 m. 3 to 6 mils in an emulsion with mucilage of acacia or tragacanth, or with milk, as water precipitates the resin.

ACTION AND THERAPEUTICS.

Male fern is the most certain **anthelmintic** we have for the common **tapeworm** and the bothriocephalus latus. The pharmacopœial dose of the extract is rather small, and 2 or even 3 fl. dr. (8 to 12 mils) are often used. It may be flavoured with ginger or peppermint. The intestine should first be emptied with a mild purge to ensure the worm not being protected by food. Then the male fern should be administered, and about twelve hours afterwards another dose of the purgative should be given to clear away the dead worm. It is well not to use castor oil, for filicic acid, which is believed to cause the toxic symptoms mentioned below, being soluble in this, may be absorbed. Very little food should be taken during the treatment, and the head of the worm should be carefully searched for in the motion.

The extract kills the *Ankylostoma duodenale*, and may be given to those suffering from this parasite. It is not so efficacious as thymol.

Toxic doses are severe gastro-intestinal irritants, and also cause muscular weakness, coma, and optic atrophy.

PELLETIERINE TANNATE.

Pelletierinæ Tannas. A mixture of the alkaloids obtained from the bark of the root and stem of Punica Granatum.

CHARACTERS. A light yellow amorphous powder, slightly soluble in water, more in alcohol.

Dose, 2 to 8 gr.—12 to 50 centigrms.

Action and Therapeutics.

It has a specific action on the tapeworm. Thi parasite immersed in a 1 in 10000 solution for te minutes dies. The requisite dose may be administered in solution; being very insoluble, it passes unchanged in the stomach, and by the time it reache the intestine enough of it is dissolved to kill the tapeworm. It should be followed after two hours by a purge, and should be given on an empty stomach.

CUSSO.

Cusso. *Synonym.*—Kousso. The dried panicles of pistillate flowers of *Brayera anthelmintica*. Abyssinia.

Characters.—In compact clusters or rolls, 3 to 6 decimetres long. Odour tea-like. Taste bitter. Separate panicles, branched, zigzag, with hairs and glands on them, and a large bract at the base of each branch. Flowers numerous, small, shortly stalked, unisexual. Two bracts at the base of each flower. Calyx hairy, veiny; five segments on each of two alternating whorls.

Composition.—The chief constituents are—(1) Koussin, or Koussotoxin, a neutral active principle soluble in alkalies. (2) Oil, gum, tannic acid, and resin.

Dose, 120 to 240 gr. 8 to 16 grms.

Action and Therapeutics.

Cusso is rarely given in England, but is used abroad as an **anthelmintic** for all species of tapeworm. It is best given as an infusion, which is drunk without straining.

MELON PUMPKIN SEEDS.

Cucurbitæ Semina Præparata. Melon Pumpkin Seeds. *Synonym.*—Pepo. The prepared fresh rip seeds of cultivated plants of *Cucurbita maxima*.

Characters.—Flat, ovate, white, consisting of two fleshy, easily separable, cotyledons, which have been freshly deprived of the yellowish outer and brownish inner integument.

Dose, 3 to 4 oz.—about 100 grms.—bruised with a little water or milk to a creamy consistence. When used the seeds must not be more than one month old.

ACTION AND THERAPEUTICS.

These seeds are an efficient anthelmintic for the tapeworm. The patient should have a light supper of bread and milk; in the early morning he should take the above dose of seeds; a cup of tea or coffee an hour later, but no food; at 10 A.M. a good dose of castor oil or some other simple purge; and two hours later a substantial meal. They are used chiefly in the Mediterranean colonies.

EMBELIA.

Embelia.—The dried fruit of *Embelia ribes* and of *Embelia robusta*.

CHARACTERS. Globular, 4 millimetres in diameter, dull red, with dark spots; contains a horny reddish seed.

Dose, 60 to 240 gr. 4 to 16 grms.

ACTION AND THERAPEUTICS.

These berries powdered, or an infusion made from them, form an excellent anthelmintic for tapeworm. The taste is not unpleasant, and the general directions are the same as those given for administering melon pumpkin seeds. Chiefly used in India and the East.

CLASS II. Anthelmintics used for Roundworm.

Santonin, Butea Seeds.

SANTONIN.

Santoninum.—Santonin, $C_{15}H_{18}O_3$. A neutral crystalline principle obtained from santonica, the dried unexpanded flower heads or capitula of *Artemisia maritima*, var. *Stechmanniana*.

CHARACTERS.—Colourless, flat, glittering, rhombic prisms, turning yellow on exposure to light. Tasteless or feebly bitter. *Solubility.*—Not at all in mineral acids, feebly in cold water, easily in chloroform. It forms santonates with alkalies.

Dose, 1 to 3 gr.—6 to 20 centigrms.

Preparation.

Trochiscus Santonini.—0·06 grm. or 1
each with a simple basis.

ACTION.

Santonin is commonly said to be **anthelm**
killing the roundworm, *Ascaris lumbricoides*, b
outside the body but at the body temperature, it
not kill this worm, it is supposed that it gets rid
parasite by in some way compelling it to pass in
large intestine, from which it is expelled by the
usually given. It has little or no action ag
other intestinal parasites. Some of the santon
absorbed as sodium santonate. Medicinal dose
usually cause the urine, if it is acid, to be a gree
yellow or saffron colour, and if it is alkaline
purplish red. This is due to the excretion in
fluid of some substance resulting from the cha
undergone by santonin in the body. It is sli
diuretic. Often even small doses lead to xanth
—that is to say, everything the patient sees b
yellow tint; this is not the result of the staini
the tissues of the eye yellow, but is a direct effec
some other part of the visual path. Sometimes
yellow vision is preceded by violet vision.

Several cases of fatal poisoning by santoni
on record. Cerebral symptoms are very promin
Thus convulsions, accompanied by unconsciousn
trismus, and dilated pupils, are generally pres
The surface becomes cold, there is sweating, t
may be trembling, the pulse and respiration bec
weaker and weaker, and death takes place f
cardiac and respiratory failure.

THERAPEUTICS.

Santonin is used solely to get rid of intest
worms. The dose of it should be given on an em

stomach, and should be followed in two hours by a purgative, such as calomel. Santonin is certainly very efficacious for the *Ascaris lumbricoides*. The lozenge is not to be recommended, for it may not dissolve, and then will probably fail to kill the worm. A good way to give santonin is to suspend it and castor oil in mucilage flavoured with peppermint. As already mentioned, probably it has no effect on the *Oxyuris vermicularis* when given by the mouth, but a suppository made with oil of theobroma, and containing 4 grains (25 centigrms.) of santonin, is said to kill this parasite.

BUTEA SEEDS.

Buteæ Semina.—The seeds of *Butea frondosa*.

Characters. Flat, reniform, about 30 mm. long, 20 mm. wide, and 1½ mm. thick. Skin glossy, dark reddish brown.

Preparation.

Pulvis Buteæ Seminum. Soak Butea seeds in distilled water; carefully remove the integuments; dry and powder the kernels.

Dose, 10 to 20 gr.—6 to 12 decigrms.

Action and Therapeutics.

Externally a paste made from these seeds has been used for ringworm. Internally the powder is given as a laxative and anthelmintic for roundworms, in place of santonin. A dose of 20 grains a day for three successive days usually suffices.

Class IV. Parasiticides used for Pediculi.

STAVESACRE.

Staphisagriæ Semina.—Stavesacre Seeds. The dried ripe seeds of *Delphinium staphisagria*.

Characters.—Irregularly triangular or obscurely quadrangular, arched, blackish brown when fresh, but becoming dull greyish brown by keeping. Testa wrinkled and deeply

pitted, nucleus soft, whitish and oily. No marked odo
Taste nauseous, bitter and acrid.

Composition. The chief constituents are (1) A fix
oil. (2) A very poisonous alkaloid, *delphine*, acting like acon
tine. (3) Other alkaloids.

Preparation.

Unguentum Staphisagriæ. Crushed see
20 ; yellow beeswax, 10 ; benzoated lard, 85

In India benzoated suet should be used instead
benzoated lard.

Action and Therapeutics.

Stavesacre is only used as a **parasiticide** to ki
pediculi. The affected part is rubbed with the oint
ment, which in the case of pediculi vestimentoru
is allowed to soak, day and night, into the garment
next to the skin, for the parasite inhabits them. I
is often employed, but it will be remembered tha
many other parasiticides for pediculi have been
mentioned (*see* p. 48).

GROUP XI.

Vegetable Drugs apparently having chiefly a Diuretic Action.

Uva Ursi, Scoparium, Couch Grass.

UVA URSI.

Uvæ Ursi Folia. *Synonyms* Bearberry leaves
The dried leaves of *Arctostaphylos uva-ursi*. Britain.

Characters. Very shortly stalked, yellowish green, obovate or spathulate, coriaceous, about 2 centimetres long. Upper surface smooth and shining; under paler, minutely reticulated. Taste very astringent. *Resembling Uva Ursi.* - Senna (*see* p. 503) and buchu (*see* p. 572).

Composition. The chief constituents are—(1) *Arbutin*, $C_{25}H_{34}O_{14}$, a bitter crystalline glucoside yielding glucose, hydroquinone, and methyl-hydroquinone. (2) Ericolin, a bitter crystalline glucoside. (3) Urson, a tasteless neutral body. (4) Tannic and gallic acids, 33 per cent.

INCOMPATIBLES.—Iron, lead and silver salts, alkaloids, and gelatin.

Preparation.

Infusum Uvæ Ursi. 1 in 20 of boiling water. **Dose, ½ to 1 fl. oz. 15 to 30 mils.**

ACTION.

Uva Ursi is a well-marked **diuretic**, and is **astringent and disinfectant** to the **urinary mucous membrane.** Its disinfectant action is probably due to the decomposition of the arbutin into glucose and hydroquinone, for after Uva Ursi is given hydroquinone is found in the urine, and it is a very energetic antiseptic. This decomposition must take place in the kidneys, for hydroquinone is a powerful poison. Against this being the reason of the disinfectant action of Uva Ursi, it is urged that giving arbutin does not disinfect the urine; but others deny this, and believe that arbutin itself is a urinary antiseptic and a diuretic. The urine may be a pale greenish to dark greenish-brown colour. Hydroquinone is also found in the urine in carbolic acid poisoning (*see* p. 338). The astringent action of Uva Ursi on the urinary tract is usually ascribed to the gallic and tannic acids, but as these are not remote astringents this is most likely wrong.

THERAPEUTICS.

Uva Ursi is given to disinfect the urine in the same class of cases as buchu—that is to say, in **pyelitis, cystitis, and gonorrhœa.**

BROOM.

Scoparii Cacumina. Broom Tops. The fresh and dried tops of *Cytisus scoparius*. Indigenous.

CHARACTERS.—The stem is dark green, with long, straight, alternate branches. The latter, like the stem, are winged, tough and flexible. Occasionally with leaves attache These are small, sessile and simple above, stalked and trifolia below. Taste bitter and nauseous. When bruised gives peculiar odour if fresh.

COMPOSITION.—The chief constituents are (1) *Scoparin* $C_{21}H_{22}O_{10}$, a yellow, crystalline, neutral principle, which diuretic. (2) *Sparteine*, $C_{15}H_{26}N_2$, an oily, liquid, volatil alkaloid; it also is said to be diuretic.

Preparations.

1. **Infusum Scoparii.**—*Dried* broom tops, 1 boiling water, 10.

Dose, 1 to 2 fl. oz. 30 to 60 mils.

2. **Succus Scoparii.** Juice of the *fresh* broo tops, 3; alcohol (90 per cent), 1.

Dose, 1 to 2 fl. dr.—4 to 8 mils.

ACTION.

Broom has no external action, and very littl beyond the fact that it is **diuretic** is known abou its internal action. Sparteine slightly increases th force of the heart like digitalis, but it is not nearl so certain in its action. It paralyses periphera nerve-endings like coniine. Scoparin is the chie diuretic principle of broom, acting directly on th renal epithelium.

THERAPEUTICS.

Broom is a very useful diuretic. It is usuall given in combination with other diuretics in cases o dropsy from heart disease or interstitial nephritis If there is acute renal inflammation it should no be prescribed. Sparteine has been tried (best give as the sulphate, dose 1 to 4 gr., 6 to 25 centigrms. in mitral disease, but it is certainly not so valuabl as digitalis.

COUCH GRASS.

Agropyrum. *Synonym.*—Triticum. The dried rhi zome of *Agropyrum repens* freed from leaves and rootlets.

Characters. Pale yellow, from 2 to 2½ mm. in diameter, usually in sections 3 to 6 mm. long. Strongly furrowed longitudinally, hollow except at nodes. No odour. Slightly sweet.

Preparations.

1. Decoctum Agropyri.—1 in 20.

Dose, ½ to 2 fl. oz. 15 to 60 mils.

2. Extractum Agropyri Liquidum. Digest couch grass with boiling water and add alcohol (90 per cent.).

Dose, 1 to 2 fl. dr.—4 to 8 mils.

Action and Therapeutics.

It is demulcent, and perhaps slightly diuretic. By many, couch grass is much given as a urinary sedative in cystitis and gonorrhœa. The pharmacopœial dose is frequently exceeded. It is used chiefly in Australian Colonies, Eastern Colonies, and North American Colonies.

GROUP XII.

Vegetable Drugs acting locally on the Uterus.

Ergot, Hydrastis, Cotton Root Bark, Viburnum.

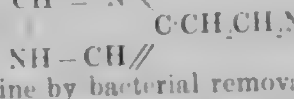
ERGOT.

Ergota.—Ergot. The sclerotium (compact mycelium or spawn) of *Claviceps purpurea*, originating in the ovary of *Secale cereale*, the common rye. It should be thoroughly dried and kept in air-tight containers and should not be used if more than one year old.

Ergot is no part of the rye grain, which completely disappears as the ergot develops.

Characters.—Subcylindrical, tapering at both ends, curved, 1½ to 4 centimetres long. Longitudinally furrowed on both sides, especially the concave, often cracked. Dark violet-purple without, pinkish white within. Fracture short. Odour peculiar, disagreeable. Taste mawkish, rancid.

Composition.—The chief constituents are—(1) *Ergotoxin*, $C_{35}H_{41}O_6N_5$, an amorphous alkaloid forming a crystalline phosphate. It is physiologically very active and is the cause of the activity of the impure bodies called sphacelinic acid and sphacelotoxin. (2) *Ergotinine*,

$C_{35}H_{39}O_5N_5$, is the anhydride of ergotoxin. It is inert physi logically. (3) *Tyramine* or parahydroxyphenylethylamin $OH\,C_6H_4\,CH_2\,CH_2\,NH_2$. This has a powerful physiologic action resembling that of adrenalin. t may also be obtain from putrid meat and from tyrosine by loss of CO_2 caus by bacteria. (4) *Isoamylamine*, $(CH_3)_2\ CHCH_2CH_2NH_2$. exists in such small quantities in ergot that it does not aff its physiological action. It occurs in putrid meat and m be derived from leucine by the loss of CO_2. (5) *β-iminazol ethylamine*,  $$\begin{matrix} CH = N\diagdown \\ \quad\quad\quad C{\cdot}CH_2CH_2NH_2 \\ NH - CH /\!/ \end{matrix}$$ This may be form from histidine by bacterial removal of CO_2 and is also pres in extracts of intestinal mucous membrane. It has a pow ful physiological action. (6) A fixed oil, 30 per ce (7) Trimethy amine, to which the odour is due. (8) Tann (9) Saponin.

Dose, 15 to 60 gr.—1 to 4 grms.

Preparations.

1. **Extractum Ergotæ.**—*Synonym.*– Ergo Macerate ergot, 100; with water, 750; evaporate, alcohol (90 per cent.), 65; and evaporate to a extract.

Dose, 2 to 8 gr. 12 to 50 centigrms.

2. **Injectio Ergotæ Hypodermica.** Ext of ergot, 33; distilled water, 100; carbolic acid, preserve it. *Strength.* 33 per cent. of the extrac

Dose, 5 to 10 m. 3 to 6 decimils—hypo mically. It should be recently prepared.

3. **Extractum Ergotæ Liquidum.** E 1000; extracted with water, 7500; and alcohol per cent.), 375.

Dose, 10 to 30 m. 6 to 18 decimils.

4. **Infusum Ergotæ.** 1 in 20 of boiling wa

Dose, 1 to 2 fl. oz.—30 to 60 mils.

5. **Tinctura Ergotæ Ammoniata.** — E powdered, 5; solution of ammonia, 2; alcohol (6 cent.), to make 20. Percolate.

Dose, ½ to 1 fl. dr.—2 to 4 mils—or l very frequently repeated.

This tincture is ammoniated, as ammonia is said the best solvent for the active principles of ergot.

As the solubility and stability of the constituents many believe it is best to give the powdered drug.

ACTION.

Ergotoxin has been shown by Dale to be the most powerful ingredient of ergot. It acts on the motor nerve-endings of the uterus, causing powerful contraction and even abortion in some pregnant animals, e.g. the cat. By similar action it contracts the pupil, the bladder, and the arterioles, thus causing a considerable rise of blood-pressure and gangrene of the comb in fowls. Tyramine, and to a less extent isoamylamine, have the same action as adrenalin.

Iminazolylethylamine stimulates the muscle of the uterus directly, and in some animals that of the bronchioles. In a similar manner it contracts most arterioles. The heart is slightly stimulated. The salivary glands are excited, and vomiting and purging occur. These ingredients of ergot are rarely given separately, and the following account refers to the action of ergot itself, but this differs much in different animals.

External.—None.

Internal. — *Gastro-intestinal tract.* — The unstriped muscle of the intestine is stimulated by ergot, and this leads to increased peristaltic movements, but rarely strong enough to cause relaxation of the bowels. The vessels of the intestine are constricted, in part because of the contraction of their own muscular fibres, and in part because of the contraction of those of the intestinal muscular coat. The result is that the intestine is blanched.

Blood.—The active principles of ergot are readily absorbed, but they are not known to produce any effect on the blood.

Heart.—The heart muscle is directly excited by ergot, and because of this and the vascular constriction the blood-pressure rises.

Vessels.—Occasionally there is a preliminary fall of blood-pressure, said by Dixon to be due to im-

purities, but this is soon followed by a great rise, an
this is chiefly due to the **general contraction** of th
arteries all over the body ; they can, in some parts, b
seen to become smaller, especially in the splanchni
area. This vascular contraction is slightly less if th
spinal cord is destroyed, from which it is fair to infe
that it is partly due to the action of ergot on the vas
motor centres in the cord, but the drug acts chiefl
directly on the muscular coat of the vessels or th
termination of the nerves in the muscles, exactly a
does adrenalin. The pulmonary arterioles are n
constricted. If the ergot be taken for a long tim
the contraction of the arterioles, together with th
associated thickening of their walls produced by th
ergotoxin, leads to **gangrene** of various parts of th
body, and this was a prominent symptom of ergotis
(chronic poisoning by ergot) which used to be se
in the very poor who could get no better food th
rye infested with *Claviceps purpurea*. Enormo
single doses of ergot appear to paralyse the vas
motor centres, and then the blood-pressure falls fro
vascular dilatation and cardiac depression.

Nervous system.—Medicinal doses, or even
enormous single dose, very rarely affect the nervo
system, but if ergot be taken for a long time, a pecul
train of symptoms sets in; they constituted
second variety of chronic ergotism in the days wh
diseased bread was eaten. The sufferer first co
plained of itching and tingling, and a sensation
insects running over the skin ; this was followed
numbness and **local anæsthesia**. These sympto
first appeared in the hands and feet, but spread o
the whole body. They were followed by **tonic c**
tractions of various muscles, especially those of
extremities. The muscular power was lessened,
the gait was staggering. **Dimness of vision**, los
hearing, and epileptiform convulsions were so
times present. This variety of ergotism was usu

accompanied by vomiting and diarrhœa. Death occurred from asphyxia, due to spasm and weakness of the respiratory muscles. The fact that there are two such distinct varieties of ergotism shows that ergot has an inconstant composition.

Uterus.—Ergot powerfully excites the pregnant uterus of women and the lower animals to contract and expel its contents. It is therefore called an **ecbolic.** It has very little power in human beings to cause contraction of the unimpregnated uterus.

The flow of urine, of saliva, of sweat, and of milk are slightly diminished by ergot, probably because of the general vascular constriction.

THERAPEUTICS.

The chief use of ergot is to cause efficient contraction of the uterus after labour, and so to diminish the risk of post-partum hæmorrhage. If there is any likelihood of profuse bleeding it should be given subcutaneously, so that it may act rapidly.

Ergot should be administered cautiously before the child is expelled, for the contractions produced by it not only gradually become more severe, but more prolonged, so that ultimately the uterus remains tightly contracted for several minutes; this is, of course, dangerous to the life of the child, and, if the resistance be very great, may lead to rupture of the uterus.

This drug has often been given as a hæmostatic in hæmoptysis and other hæmorrhages from different parts of the body. Some authors claim great success. Frequently it fails, and it may, by the general rise of blood-pressure, do more harm than good, especially in hæmoptysis, as the pulmonary arteries are not constricted by ergot. It is difficult to gauge its value, for so many hæmorrhages will stop even if no drugs are given.

It has been used to check the night sweats o
phthisis, and as an antigalactogogue.

It is often desirable to combine the liquid extrac
of ergot with perchloride of iron. Because of the
tannin in the ergot an inky mixture results, bu
this may be clarified by the addition of a littl
citric acid, and the taste may be covered with
chloroform water.

Ernutin.—This is fluid containing the activ
principles of ergot; 5 to 10 minims (30 to 6
centimils) may be given subcutaneously or 30 t
60 minims (2 to 4 mils) by the mouth.

HYDRASTIS.

Hydrastis Rhizoma. Hydrastis Rhizome. Th
dried rhizome and roots of *Hydrastis canadensis*, the golde
seal, yellow-root, or yellow puccoon. Grows in th
Alleghanies.

CHARACTERS.—Rhizome is 10 to 40 millimetres long, 3 t
10 millimetres thick; irregular twisted appearance. Scars o
decayed stems on the upper surface. Yellowish brown wit
short fracture. Interior yellow. Taste very bitter.

COMPOSITION. It contains—(1) Hydrastine, an alkaloi
$C_{21}H_{21}NO_6$. White prismatic crystals, insoluble in wate
Dose. ½ to 1 gr. 3 to 6 centigrms. in a pill. (2) Cana
dine, (3) Berberine, an alkaloid.

Preparations.

1. Extractum Hydrastis Liquidum. Powdered hydrastis rhizome, exhausted by percolation wit
alcohol (60 per cent.).

This liquid extract contains 2 per cent. o
hydrastine.

Dose. 5 to 15 m.—3 to 10 decimils.

2. Tinctura Hydrastis.—Liquid extract o
hydrastic rhizome, 1; alcohol (60 per cent.), 10. Mi

Dose. ½ to 1 fl. dr.—2 to 4 mils.

The Hydrochloride of Hydrastinine, an oxidation produ
of hydrastine, is often used. It exists as pale yellow crystal
oluble 1 in 1 of water.

Dose. ¼ to 1 gr.—15 to 60 milligrms. hyp
dermically

ACTION.

Hydrastis in small doses acts as a gastric bitter, promoting the appetite, and stimulating the gastro-intestinal secretions and peristalsis. It is stated, probably incorrectly, to increase the flow of bile. Moderate doses stimulate the medullary centres, thus breathing is quicker and deeper, the heart is slowed, the arterioles are contracted, and blood-pressure rises. Large doses depress the centres, the pulse becomes rapid, blood-pressure falls, and the patient dies from paralysis of respiration. It produces convulsions similar to those of strychnine. In the lower animals it stimulates unstriped muscle and is said to increase uterine contractions and induce abortion, but this is doubtful. Its action is mainly due to the alkaloid hydrastine. It has been stated that this, before it acts, is oxidized into hydrastinine, but against this is the fact that it is excreted unchanged in the urine.

Hydrastinine, like hydrastine, contracts arterioles and raises the blood-pressure. It slows but does not depress the heart. It is said to cause contraction of the uterus by direct action on its muscle, and because of this action and that on arterioles it is used to arrest uterine hæmorrhage.

THERAPEUTICS.

External.—Hydrastis is employed empirically as a local stimulating application in chronic inflammations, such as unhealthy ulcers. It is used also as a lotion in excessive sweating, acne, and seborrhœa. Either of the preparations may be employed, if diluted with water.

Internal. The chief use of hydrastis is that it is empirically administered for chronic inflammation of mucous membranes. It is said to be especially suitable for uterine affections, particularly menor rhagia and dysmenorrhœa. It is given to st uterine hæmorrhage and to arrest the growth uterine tumours (*see also* Cotarnine, p. 382). Fo all these diseases hydrastinine hydrochloride ha been much used. Hydrastis is also employed the chronic gastritis of drunkards, and to a rath less degree in other forms of chronic gastro-intestin catarrh. As an injection or lotion it is employ (either preparation diluted with an equal part water) for chronic nasal catarrh, otorrhœa, leuco rhœa, gonorrhœa, and as a mouth wash in aphtho stomatitis, chronic pharyngitis, &c. Some autho claim that it is useful for the same diseases of t heart as are benefited by digitalis. As an antiperiod it is far inferior to quinine.

COTTON ROOT BARK.

Gossypii Radicis Cortex. The dried root b of *Gossypium herbaceum* and of other cultivated species.

CHARACTERS. Thin flexible bands or quilled pie covered with a thin brownish yellow periderm.

Preparations.

1. **Decoctum Gossypii Radicis Corticis** 1 in 5.

Dose, ½ to 2 fl. oz. 15 to 60 mils.

2. **Extractum Gossypii Radicis Corti Liquidum.** Cotton root bark, 100; glycerin, alcohol (90 per cent.), 100. Percolate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

Action and Therapeutics.

By many the action of this drug is though resemble that of ergot, and it is used in uter diseases for the same purposes. It is chiefly ployed in India, the East and West Indies, North America.

BLACK HAW.

Viburnum.—Black Haw. The dried bark of *Viburnum prunifolium.*

CHARACTERS. In quills or curved pieces, 1 to 4 millimetres thick, dull brown. Outer surface longitudinally wrinkled, or in older bark with shallow fissures and scaly. Taste astringent.

Preparation.

Extractum Viburni Liquidum.—1 in 1 of alcohol (70 per cent.). Percolate.

Dose, 1 to 2 fl. dr.—4 to 8 mils.

ACTION AND THERAPEUTICS.

The active principle has not been isolated, but black haw contains viburnin, and valerianic, tannic, gallic, oxalic, citric, and malic acids. From physiological experiments black haw appears to depress the motor functions of the cord, and so produce paralysis and loss of reflex. At the same time it depresses the heart, lowers the blood-pressure, and causes death by cardiac paralysis. In man large doses cause dimness of vision, dryness of mouth, and headache. Therapeutically, the drug has been used in hysteria, hystero-epilepsy, diarrhœa, dysentery, and, freely diluted, as a gargle in sore throats; but these uses are unimportant, and its chief employment is in obstetric diseases. In these it is used as a sedative; thus it is given a few days before the period in dysmenorrhœa and in menorrhagia; it is given to control uterine hæmorrhage during the menopause, and to relieve pains preceding and following childbirth. Given in the earlier months of pregnancy it is said to overcome the habit of miscarriage. It is used chiefly in India, the East, and North America

GROUP XIII.

Colchicum, Piperazin.

These drugs are used for gout.

COLCHICUM.

Colchici Cormus. Colchicum Corm. The fr
corm of *Colchicum autumnale*, collected in the early summ
or the same stripped of its coats, sliced transversely, and dr
at a temperature not exceeding 65 C. Britain.

CHARACTERS.—Fresh corm 35 millimetres long, 25 mi
metres broad, conical, flattened on one side, rounded on
other; outer coat thin, brown, membranous, inner coat redd
yellow. Internally white, solid, yielding milky juice of bit
taste and disagreeable odour. Dried slices 2 or 3 mm. thi
yellowish at circumference, indented one side, convex
other, and thus reniform in outline. Surfaces firm, whit
amylaceous. Fracture short. Odour none. Taste bitter.

COMPOSITION.—The chief constituents are—(1) *Colchic*
the active alkaloid, yellowish, micro-crystalline, soluble
water and alcohol, but changed by most acids into colchice
(2) Veratrine (*see* p. 463), in traces combined with gallic a
(3) A fixed oil. (4) Starch, sugar, gum.

INCOMPATIBLES.—All astringent preparations, tincture
iodine, and tincture of guaiacum.

Preparations.

1. Extractum Colchici.—Made from the
corm by pressing out the juice, filtering
evaporating.

Dose, ¼ to 1 gr. 16 to 60 milligrms.

2. Vinum Colchici. Colchicum corm,
sherry, 5. Macerate.

Dose, 10 to 30 m. 6 to 18 decimils.

Colchici Semina. The dried ripe seeds of Co
um autumnale.

CHARACTERS.—Two and a half millimetres in diame
subglobular, pointed at hilum, reddish brown, rough, very h
and difficult to powder. Odour, none. Taste bitter, a
Resembling colchicum seeds.—Black mustard seeds.

COMPOSITION.—The chief constituents are—(1) The s
as of the corm, but the proportion of the active alkaloid co
cine is larger. (2) A volatile oil in addition.

Preparation.

Tinctura Colchici. Colchicum seeds, 1 ; alcohol (70 per cent.), 10. Percolate.

Dose, 5 to 15 m 3 to 10 decimils.

This represents Tinctura Colchici Seminum, B. P. 1898. It is one half the strength of that preparation.

ACTION.

External. When applied to the skin colchicum acts as an irritant, causing hyperæmia and smarting, and the dust inhaled gives rise to sneezing.

Internal.—*Gastro-intestinal tract.*—In moderate medicinal doses colchicum produces no effect on most persons beyond perhaps slightly increasing the secretion of bile, but with others it causes loss of appetite, and a little **purging, nausea**, and **colic**. In larger doses it gives rise, in all persons, to great abdominal pain, vomiting, and profuse diarrhœa with the passage of blood. Like pilocarpine, but even more powerfully, it increases the secretion and stimulates the muscle. It is in fact a powerful **gastro-intestinal irritant**. There is also great prostration, the pulse becomes small, rapid, and thready, the skin cold and bedewed with sweat, and the respiration slow ; death is due to collapse. It is probable that these results are not, to any large extent, owing to the effect of colchicine on the heart or respiration, but that they are the consequence of the severe gastro-enteritis, which, it is well known, will cause fatal collapse. They are produced if colchicine is injected subcutaneously, a circumstance which indicates that this alkaloid is an active principle of colchicum, and that it is excreted into the intestine. It is said that after a certain point increasing the quantity does not lead to an increase of the symptoms. In animals the action on the heart is not marked, but diarrhœa and vomiting are severe.

Nervous system. Medicinal doses have no effect. Even a fatal dose does not impair consciousness.

Cold-blooded animals bear much larger proportionat
doses than warm, but in all, after large quantitie
sensation is paralysed, and ultimately the spin
motor centres are powerfully depressed, death takin
place from respiratory paralysis. Colchicine is sa
to act on muscles like veratrine.

Kidneys.—The most discordant statements ha
been made about the action of colchicum on t
urine, but it has not been definitely shown th
either the quantity or composition, even in t
amount of uric acid, is altered. After death
poisoning, the alkaloid is found in the blood and
most of the organs of the body.

Blood.—The first effect is to diminish the numb
of polymorphonuclear cells in the blood owing
their collection in the tissues, especially the marro
but soon there are fewer in the tissues and an en
mous increase in those of the blood.

THERAPEUTICS.

Colchicum is hardly ever used except for **go**
Given during the attack, it most markedly relie
the pain; in smaller doses given between the atta
it diminishes their severity. It is often useful
dyspepsia, eczema, headache, neuritis, conjunctivi
bronchitis, and other conditions which, when occ
ring in those suffering from gout, are probably rela
to it. It is a true specific; how it acts is not kno
Occasionally it is combined with other repu
cholagogues, especially if it is desired to give th
remedies to a person who is the subject of gout.
any symptoms of gastric or intestinal irrita
appear, its use must be discontinued for a ti
Those who take it should keep the bowels
open, lest it should accumulate in the body. He
it is commonly combined with sulphate of mag
sium. The seeds are said to be more active t

the corm. Colchicine salicylate, often known as colchisal, frequently relieves gouty pains. The dose is $\frac{1}{60}$ grain (1 milligrm.).

Piperazin.—(Not official.)

This organic base is formed by the action of sodium glycol on ethylenediamine hydrochloride. It was originally thought to be the same as spermine, an organic ferment obtained from the testicle, but it is quite a different body. It occurs in small colourless crystals soluble in water. Outside the body it is a powerful solvent of uric acid, but Fawcett ("Guy's Hospital Reports," vol. li.) and others have shown that the urine of a person taking piperazin will not dissolve uric acid, nor does it benefit gout. In spite of this evidence of its apparent uselessness it is much given, usually in 5-gr. (3 decigrms.) doses of a granular effervescing powder dissolved in half a tumbler of water. Some gouty patients profess to be much benefited by it, but others say it makes them worse. Lycetol (dose, 4 to 10 gr., 25 to 60 centigrms.) and Lysidine (dose, 10 to 30 ♏, 6 to 18 decimils) are bodies having a similar action.

GROUP XIV.

Camphor, Thymol, and Menthol are white solids, closely related to volatile oils, Ajowan oil is a volatile oil, all are antiseptic (two very powerfully so), and two at least, and probably all, are local anæsthetics.

Camphor, Thymol, Ajowan Oil, Menthol.

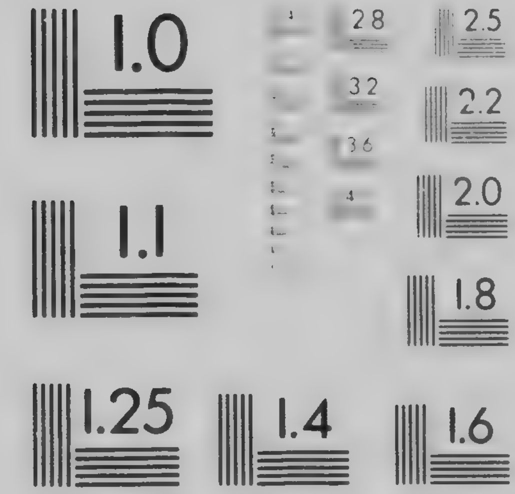
CAMPHOR.

Camphora.—$C_{10}H_{16}O$. A white crystalline substance obtained from *Cinnamomum camphora*, the camphor laurel, and purified by sublimation.

Characters.—Solid, colourless, translucent, crystalline masses; also in rectangular tablets or pulverulent masses known as "flowers of camphor." Tough, but readily powdered if mixed with alcohol, ether, or chloroform. Odour powerful, characteristic. Taste pungent, bitter, followed by a sensation of cold. Floats on water. Sp. gr. 0·99. Burns readily with a bright smoky flame. Volatilizes slowly at ordinary temperatures. Sublimes entirely when heated. *Solubility.*—1 in 700

MICROCOPY RESOLUTION TEST CHART

ANSI and ISO TEST CHART No. 2



APPLIED IMAGE Inc

of water, 1 in 2 of oil of turpentine, 1 in 4 of olive oil, readily in milk, ether, alcohol, or chloroform. When triturated with either chloral hydrate, carbolic acid, or thymol it forms a thick liquid

COMPOSITION. Camphor, $C_{10}H_{16}O$, is an oxidation product of pinene (*see* Oil of Turpentine), and may also be derived from cymene found in caraway and eucalyptus oils (*q.v.*). The pharmacopœial camphor is called laurel camphor; it is dextro rotatory. Lævo-rotatory and inactive camphors are known. Borneol, $C_{10}H_{18}O$—known also as Borneo camphor is often in commerce substituted for official camphor, which it closely resembles; it is derived from *Dryobalanops aromatica*, and is known from the official camphor by sinking in water; it is an alcohol. The common form of Borneol is dextro-rotatory, but lævo-rotatory and inactive varieties are known.

Dose, 2 to 5 gr. 12 to 30 centigrms. as a pill, with glucanth and wheaten flour as an excipient.

Preparations.

1. **Aqua Camphoræ.**—Dissolve 1 grm. in 2 millilitres of alcohol (90 per cent.), and add to 1000 millilitres of distilled water. Contains about ½ gr. to 1 fl. oz.
Dose, 1 to 2 fl. oz. 30 to 60 mils.

2. **Linimentum Camphoræ.** *Synonym.*—Camphorated Oil.—Camphor, in flowers, 1; olive oil, 4.

3. **Linimentum Camphoræ Ammoniatum.**—*Synonym.*—Compound Liniment of Camphor. Camphor, 125; strong solution of ammonia, 250; oil o lavender, 5; alcohol (90 per cent.), to 1000.

4. **Spiritus Camphoræ.** Camphor, 1; alcoho (90 per cent.), to produce 10.
Dose, 5 to 20 m. 3 to 12 decimils. In milk or on sugar, as water precipitates the camphor.

5. **Tinctura Camphoræ Composita**, *see* Opium p. 363.

Camphor is contained in the following liniments: Aconiti Belladonnæ, Chloroformi, Hydrargyri, Opii, Saponis, Sinapis Terebinthinæ, and Terebinthinæ Aceticum; and in Unguentum Hydrargyri Compositum.

Spiritus Camphoræ Fortior, known as Rubini's solution o camphor, is 1 of camphor in 1 of absolute alcohol.

ACTION.

External. Camphor, although not a volatile oil, acts very much like one. Thus it is a direct cutaneous stimulant, dilating the vessels of the skin, and at first causing a sensation of **warmth**, but subsequently a slight degree of local **anæsthesia**. It is a feeble antiseptic.

Internal.—*Gastro-intestinal tract.*—In the stomach it is mildly **stimulant**, dilating the vessels, increasing the flow of gastric juice and the peristalsis. Hence it is stomachic and carminative. It has a slight reflex stimulating effect on the heart. In ordinary doses it has little action on the intestines.

Absorption.—It is quickly absorbed, both from the intestines and skin, and two bodies formed in the body from it are known. One, camphorol (one atom of H in camphor is replaced by OH), combines with glycuronic acid and is excreted in the urine as camphoglycuronic acid. Another, an amido derivative, is also found in the urine.

Circulation. It increases the number of polymorphonuclear cells in the blood. The heart is excited directly by it in addition to the reflex stimulation just mentioned, and so the pulse becomes fuller and stronger; the rate is not much affected. The face may be flushed. The effect on the circulation is very slight in man.

Respiration.—Probably camphor or some derivative from it is excreted by the bronchial mucous membrane, the vascularity and secretion of which are consequently stimulated. It has the reputation of being a feeble expectorant.

Skin. It is a mild **diaphoretic**. This effect is believed to be due to the action of the drug on the central nervous system. Probably camphor or some derivative from it is excreted by the skin, for the sweat may smell of it.

Nervous system.—Different people are differently susceptible to the effects of camphor. Five t ten grains will, like alcohol, in some persons produc a feeling of exhilaration, or in others a sense of comfort and quietness. Larger doses cause excitement giddiness, staggering, a slow pulse, and ultimatel headache, burning pains in the stomach, faintness confusion of ideas, delirium, violent convulsions insensibility, a small feeble pulse, and finally deat from collapse. In mammals, including man, camphor acts by first stimulating and subsequentl depressing the cerebral cortical areas. It is a mil antipyretic.

Sexual organs.—Camphor is reputed to be a aphrodisiac, but this is probably incorrect.

THERAPEUTICS.

External. Its stimulating effects make campho a favourite ingredient of many liniments. It i constantly rubbed into the skin in some form o another as a mild irritant or counter-irritant in, fo example, chronic rheumatism, chronic inflammator indurations, and the slighter chest complaints o children; and also in myalgia, neuralgia, lumbago and sciatica, in which cases, because of its property o causing local anaesthesia, it relieves pain. In additio to the pharmacopœial preparations, a Chloroformum Camphoræ B. P. C. (camphor, 2 parts, dissolved i chloroform, 1 part) may be used. The liquid preparations with chloral, carbolic acid, and thymol ar excellent local anodynes for neuralgia, and may b dropped into a tooth to relieve toothache.

Internal. Camphor is used as a carminative especially for neurotic subjects. It is a commo remedy for a cold in the head, and is probably beneficial on account of its stimulation of the circulatio and its slight antipyretic and diaphoretic effect

Many expectorant mixtures contain camphor. Large doses are said to check diarrhœa. It has been given as an antispasmodic in hysteria and allied conditions, and some state that it is of use in cholera and as a stimulant when the heart is weak. It is believed to greatly lessen the disagreeable symptoms that follow on cessation of the morphia habit, and it was largely used in Germany as a cardiac stimulant, 3 grains (20 centigrms.) or more being injected subcutaneously as a solution in sterilized olive oil; but it is probably of little use.

THYMOL.

Thymol.—*Synonym.* Isopropyl metacresol $C_{10}H_{14}O$. A crystalline substance obtained from the volatile oils of *Thymus vulgaris*, *Monarda punctata*, and *Carum copticum*. Purified by recrystallization from alcohol.

CHARACTERS. Large, oblique, prismatic crystals. They sink in cold water. On heating the water they melt and the thymol rises to the surface. Odour of thyme. Taste pungent, aromatic. *Solubility.* 1 in 1500 of cold water, 1 in 190 of glycerin, 1 in 2 of olive oil. Freely in alcohol, ether, or chloroform.

Dose, ½ to 2 gr.—3 to 12 centigrms.; 15 to 30 gr. 1 to 2 grms. (anthelmintic). Best given as a pill.

ACTION AND THERAPEUTICS.

Thymol is a more powerful **antiseptic** than carbolic acid, but its insolubility is a drawback. It has been used in antiseptic surgery. A saturated solution, thymol gauze, and thymol ointment are employed. It is non-irritating. It has considerable antiparasitic powers, and solutions in alcohol or ether (1 in 15) have been used in ringworm. A solution in glycerin (1 in 200) has been recommended for sore throats. A little alcohol is very useful for facilitating the aqueous solution of thymol.

Thymol in three successive doses of 30 gr. (2 grms.) each given in a cachet is the best anthelmintic for *Ankylostoma duodenale.* A purgativ should be given before and after. Thymol may make the urine green.

AJOWAN OIL.

Oleum Ajowan. *Synonym.*—Ptychotis oil. Th oil distilled from the fruit of *Carum copticum.*

Characters.—Colourless, with an odour and tast resembling thyme. Sp. gr. 0·91–0·93.

Dose, ½ to 3 m.—3 to 18 centimils.

Action and Therapeutics.

This oil has the same actions as thymol. A alcoholic solution of it has been used to relieve pain and it is given internally as a carminative. It i chiefly used in India and the Eastern Indies.

MENTHOL.

Menthol. $C_{10}H_{20}O$. A crystalline substance obtaine by cooling the oil distilled from the fresh herb of *Menth arvensis*, vars. *piperascens et glabrata* (Japan) and probabl other species of Mentha. It is sometimes called min camphor.

Characters.—In fused crystalline masses or as colourles acicular crystals, moist from adhering oil. Odour as of pep permint. Taste of peppermint; the subsequent coldness o inhalation of air is well marked. Its melting-point shoul not exceed 43°C. *Solubility.*—Very sparingly in water o glycerin, 5 in 1 of alcohol (90 per cent.), 4 in 1 of chlorofor 1 in 4 of olive oil.

Impurities.—Glass and magnesium sulphate.

Dose, ½ to 2 gr.—3 to 12 centigrms.

Preparation.

Emplastrum Menthol.—Menthol, 15; yello beeswax, 10; resin, 75.

Action and Therapeutics.

External.—Menthol is chiefly employed exter nally, for it produces **local anæsthesia**, a feeling o coldness and numbness, and thereby alleviates the pain of neuralgia, especially if it involves a superficial nerve. It is very efficacious in some cases. The solid menthol may be drawn along the skin, or a spirituous solution may be painted on, or the plaster may be applied. If this is used it should be spread on thin rubber cloth or hat lining, as it soaks through calico and linen. In very hot weather the pharmacopœial plaster may be too fluid, and then more wax should be added. A solution of 100 gr. (7 grm.) heated in a test-tube containing half an ounce of oleic acid is an excellent preparation, and a very good liniment is formed of menthol, 3 parts; chloroform, 4 parts; olive oil, 9 parts. The local application of menthol often relieves itching. Menthol has been applied locally to carious teeth, and has been inhaled with advantage in asthma. For teeth it is best rubbed up with an equal part of absolute phenol, camphor, or chloral hydrate. The oily liquid formed in either case may be put in the teeth. For asthma it is readily volatilised by the addition of hot water. Solutions of it have been painted on the throat in diphtheria. A pigment of 1 to 4 in olive oil is employed for painting the larynx in tubercular ulceration. Glycothymolin contains thymol, menthol, and other bodies. It is used as an antiseptic wash for mucous membranes.

Internal. Its internal administration has been abandoned, as it easily upsets digestion. It is a powerful antiseptic, and is excreted in the urine as menthoglycuronic acid, rendering it aseptic and giving it a pleasant smell. Menthol should be preserved in closed tin boxes.

GROUP XV.

Vegetable Drugs acting in virtue of important Acids they contain.

Lemon juice (citric acid). **Benzoin** (benzoic acid). **Laurocerasi Folia** (hydrocyanic acid). **Araroba, Chrysarobinum** (chrysophanic acid). **Chaulmoogra Oil** (gyno cardic acid). *Virginian prune* (*see* p. 473) and *Bitter almon* (*see* p. 609), both of which yield hydrocyanic acid, hav already been considered.

LEMON.

Limonis Cortex. Lemon Peel. The fresh out part of the pericarp of the fruit of *Citrus medica, var. Limonum.*

CHARACTERS.—Thin, pale yellow pieces, rough on the outer surface from the presence of glands containing the oil; inner surface has a little of the inner white rind attached. Fragrant odour; bitter aromatic taste.

COMPOSITION.—The chief constituents are—(1) The official *Oleum Limonis* (*see below*). (2) A bitter principle, hesperidin.

Preparations.

1. Syrupus Limonis, *see* p. 647.

2. Tinctura Limonis. Lemon peel, 1; alcohol (90 per cent.), 4. Macerate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

Lemon peel is contained in Infusum Aurantii Compositum and Infusum Gentianæ Compositum.

In India and the Colonies where fresh lemon peel cannot be obtained, the dried peel may be used for any preparations containing lemon peel.

Oleum Limonis. The oil obtained from fresh lemon peel.

SOURCE.—Obtained by expression.

CHARACTERS.—It is pale yellow, fragrant, warm, and bitter. Sp. gr. 0·857 to 0·860.

COMPOSITION.—Oil of lemon contains—(1) A terpene calle *citrene* or *limonene*, $C_{10}H_{16}$, 90 per cent., strongly dextro-rotatory This is also found in orange peel and in oil of caraway (2) Geranial or citral, the aldehyde derived from geranio found in oil of rose (p. 559). (3) Citronellal, an aldehyde o the alcohol citronellol.

Dose, ½ to 3 m.—3 to 18 centimils.

Oil of lemon is contained in Linimentum Potassii Iodid cum Sapone, Tinctura Valerianæ Ammoniata, Tinctur Guaiaci Ammoniata, and Spiritus Ammoniæ Aromaticus.

ACTION AND THERAPEUTICS.

The same as those of orange. The oil applied externally is rubefacient.

Succus Limonis. Lemon Juice. The freshly expressed juice of the ripe fruit of *Citrus medica, var. β Limonum.*

CHARACTERS. A pale yellow, slightly turbid liquid. Taste acid. Odour of lemons. 100 millilitres of lemon juice are neutralized by about 11·4 grms. of potassium bicarbonate, by about 9·5 grms. of sodium bicarbonate, and by about 16·5 grms. of sodium carbonate. It decomposes on keeping, but may be preserved by the addition of 10 per cent. of alcohol.

COMPOSITION. Lemon juice contains citric acid (*see* p. 253), both free and combined to form potassium and other salts. Also malic acid, $H_2C_4H_4O_5$, and phosphoric acid.

Preparations.

1. Syrupus Limonis. Fresh lemon peel 20, is digested in alcohol (90 per cent.) q.s. Sugar, 760, is dissolved in lemon juice 500, and the two liquids are mixed.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

2. Acidum Citricum, *see* p. 269.

ACTION AND THERAPEUTICS.

Lemon juice is used to relieve thirst, and to make effervescing mixtures and drinks. Its action in the body is the same as that of citric acid (*see* p. 269). Three or four ounces of lemon juice daily is of great benefit in scurvy. Why this is so we do not know for certain. Lemon juice is probably more efficacious than citric acid.

BENZOIN.

Benzoinum. Benzoin. *Synonym.* Gum Benjamin. A balsamic resin obtained from the incised stem of *Styrax benzoin.* Known as Sumatra benzoin.

CHARACTERS. Separate tears or masses of tears loosely agglutinated, but generally closely compacted by a deep brown translucent substance. Tears flat or curved, yellowish or reddish brown; they vary in size up to an inch or two; on breaking they either show an opaque milk-white or a reddish-brown appearance. Benzoin is very brittle, and easily softens by the heat of the mouth. Little taste. Odour balsamic. Gives off, on heating, fumes of benzoic acid. *Solubility.*—1 in 5 of alcohol (90 per cent.). Easily in ether or potash

COMPOSITION. The chief constituents are (1) *Benzoi acid* (*see below*), 12 to 20 per cent. (2) Cinnamic acid, $C_9H_8O_2$, a trace. (3) Resins. (4) Volatile oil.

Preparations.

1. **Adeps Benzoatus.**—Benzoated lard. Benzoin, 3; prepared lard, 100

2. **Sevum Benzoatum.**—Benzoated suet Benzoin, 3; prepared suet, 100.

3. **Tinctura Benzoini Composita.** *Synonym.* —Friar's balsam. Benzoin, 100; prepared storax, 75; balsam of tolu, 25; aloes, 20; alcohol (90 per cent.), to produce 1000. Macerate.

Dose, ½ to 1 fl. dr. 2 to 4 mils.

Benzoated lard is contained in several ointments, but in India *benzoated suet* should be employed in making th officinal preparations for which benzoated lard is directed t be used.

Acidum Benzoicum. Benzoic Acid. $HC_7H_5O_2$

SOURCE.—From benzoin by sublimation or syntheticall from toluene, hippuric acid, and other organic compounds.

CHARACTERS. Light, feathery, almost colourless, flexible crystalline plates or needles. *Solubility.*—1 in 450 of colc water, 1 in 12 of boiling water, readily in solutions of alkalies Sodium phosphate or borax aids its solution in water. I sublimes on heating.

Dose, 5 to 15 gr.—3 to 10 decigrms.

Preparations.

1. **Trochiscus Acidi Benzoici.** 0·03 grm. o ½ gr. in each with a fruit basis.

2. **Tinctura Camphoræ Composita.** 0·5 pe cent. of benzoic acid (*see* Opium, p. 363).

3. **Tinctura Opii Ammoniata.** 2 per cent. o benzoic acid (*see* Opium, p. 363).

Ammonii Benzoas. $NH_4C_7H_5O_2$.

SOURCE. Neutralize benzoic acid with ammonia, an evaporate.

CHARACTERS.—Colourless laminar crystals, with odour o benzoic acid. *Solubility.*—1 in 6 of water, 1 in 22 of alcoho (90 per cent.).

INCOMPATIBLES.—Per-salts of iron, Liquor Potassæ, an acids.

Dose, 5 to 15 gr.—3 to 10 decigrms.

Sodii Benzoas. $NaC_7H_5O_2$.

SOURCE. Neutralize a solution of benzoic acid with sodium carbonate, and crystallize.

CHARACTERS. A crystalline or amorphous white powder. Odour faintly benzoic. Taste sweetish, alkaline. *Solubility.* Easily in water, 1 in 24 of alcohol (90 per cent.).

Dose, 5 to 30 gr. 3 to 20 decigrms.

ACTION.

As far as is known, the action of benzoic acid, its salts, and benzoin is the same. We shall therefore only here describe the actions of benzoic acid.

External. Benzoic acid is a powerful antiseptic. The growth of many forms of bacteria is completely inhibited by a solution of 1 in 1000. In a concentrated form it is a stimulant and irritant when applied to the skin.

Internal. The chief fact about the internal action of benzoic acid that has been worked out is that when it is given by the mouth **hippuric acid appears in the urine.** This happens by combination with a molecule of glycocoll. $C_6H_5 \cdot COOH + NH_2 \cdot CH_2 \cdot COOH = C_6H_5 \cdot CO \cdot NH \cdot CH_2 \cdot COOH$ (hippuric acid) $+ H_2O$. The source of the glycocoll is not known. The conversion takes place in the kidneys, for after giving large doses of benzoic acid it alone can be found in the blood, and if the renal arteries are tied no hippuric acid is formed, but if only the ureters are tied it is formed. Also benzoic acid has been successfully converted into hippuric acid by passing blood containing benzoic acid, but no glycocoll, slowly through the kidneys removed directly after death. Further researches show that the conversion is probably effected by the renal cells. Hippuric acid has been found in the urine of new-born children when benzoic acid has been given to the mother shortly before delivery. If hippuric acid is given by the mouth benzoic acid is found in the blood, but hippuric reappears in the urine. The hippuric acid in the urine **renders alkaline urine acid**, and it stimulates and disinfects the urinary mucous membrane. Occasionally succinic as well as hippuric acid appears in the urine.

Benzoic acid or some derivative of it is probably excreted in the bronchial secretion, for the bronchial mucous membrane is stimulated by the administration of benzoic acid, the mucus being increased in quantity and disinfected. The acid is therefore **expectorant.** The same effects are brought about if the vapour of benzoic acid is inhaled.

It is said also to be excreted by the skin and salivary glands, and thereby to increase their activity. It is slightly diuretic. Medicinal doses do not produce any effect on the stomach, intestines, circulation, or nervous systems, but greatly increase the polymorphonuclear cells in the blood.

Benzoic acid and its salts are antipyretic, and it is stated that they are even more powerful than salicylic acid. How they produce a fall of temperature is not known. Metabolism is increased, as is shown by the excess of nitrogen and sulphur in the urine.

Sodium and ammonium benzoate increase both the quantity and the solids of the bile.

THERAPEUTICS.

External.—Lint soaked in the compound tincture is a very favourite dressing for wounds and sores o all sorts. Its chief advantage is the antiseptic powe it possesses. Its stimulating effect is also valuable Benzoated lard is a common basis for ointment when it is wished that the active ingredient shou be absorbed, for the lard melts on the body, especiall if covered by a bandage; the benzoin prevents th decomposition of the lard. If the benzoin irritates which it is especially likely to do if near the ey three minims of oil of cloves or two of oil of gaultheria to the ounce of lard make a non irritant basis that keeps indefinitely.

Internal. *Lungs.* Benzoin, benzoic acid and its compounds are very commonly employed as stimulating disinfecting expectorants in cases of bronchitis or phthisis in which the expectoration is foul and scanty. The vapour from a mixture of a pint of water at 52 C. and a fluid drachm (4 mils) of compound tincture of benzoin is often inhaled for bronchitis and laryngitis.

Urinary organs.—Benzoic acid is a most valuable drug for acidifying the alkaline decomposing urine which is formed in pyelitis and cystitis, and for stimulating and disinfecting the urinary tract in the same conditions. Benzoate of ammonium is so much more soluble than benzoic acid that it is to be preferred to it. Spirit of chloroform covers the taste. It may with advantage be combined with urinary sedatives, as tincture of hyoscyamus. The conversion to hippuric acid has been said not to take place when the kidney is diseased.

Benzoic acid has been used in Germany instead of salicylic acid for rheumatic fever.

CHERRY LAUREL.

Laurocerasi Folia. Cherry Laurel Leaves. The fresh leaves of *Prunus laurocerasus.*

CHARACTERS. Thick, coriaceous, on short strong petioles. Oblong or ovate, 12 to 18 centimetres long, tapering towards each end, recurved at the apex, distantly but sharply serrated, dark green, smooth and shining above, pale beneath. Prominent midrib with, on either side of it, at the base, one or two glandular depressions. Inodorous except on bruising, when they emit a prussic acid or ratafia-like odour.

COMPOSITION.—The chief constituents are (1) *Laurocerasin*, a glucoside; it is identical with amygdalin. By the same changes as is the case with bitter almonds (*see* p. 609), in the presence of moisture, an oil, prussic acid, and glucose are formed. (2) *Emulsin.*

Preparation.

Aqua Laurocerasi. Made by distillation, and *standardized* by adding either water or hydrocyanic acid till the strength of the distillate is 0·1 *per cent. of hydrocyanic acid.* That is to say, the relative strength of Acidum Hydrocyanicum Dilutum and Aqua Laurocerasi is as 20 to 1.

INCOMPATIBLES.—Metallic salts.

Dose, ½ to 2 fl. dr.—2 to 8 mils (note the dose).

ACTION AND THERAPEUTICS.

Aqua Laurocerasi is not often employed, for, owing to the volatilization of the prussic acid, its strength is inconstant. Its actions are the same as those of dilute hydrocyanic acid (*see* p. 352). It is given as a flavouring agent.

ARAROBA.

Araroba.—*Synonyms.*—Goa Powder; Crude Chrysa .obin. A substance found in cavities in the trunk of *Andira araroba*, freed as much as possible from fragments of wood, dried and powdered.

CHARACTERS AND TESTS.—The powder varies from brownish-yellow to umber brown. It should yield to ho benzene not less than 50 per cent. of a substance which after evaporating and drying, should have the characters o chrysarobin.

Used for making chrysarobin.

CHRYSAROBIN.

Chrysarobinum.—Chrysarobin.

SOURCE.—A mixture of substances extracted from Araroba by hot benzene.

CHARACTERS.—A light brownish-yellow minutely crystalline powder, tasteless and inodorous. *Solubility.*—Very sparingly in water, and sparingly in alcohol (90 per cent.).

COMPOSITION.—It consists of a definite chemical compound, $C_{15}H_{12}O_3$, also known as pure chrysarobin, o chrysophanolanthranol, associated with other substances of similar composition.

Preparation.

Unguentum Chrysarobini.—Chrysarobin, 4; soft paraffin, 96.

ACTION.

External. It is a powerful **irritant** to the skin, which it stains yellowish brown. Linen is stained the same colour. (The stain may be removed by a weak solution of caustic soda or chlorinated lime.) It is antiparasitic.

Internal.—It is cathartic and very irritating to the stomach and bowels, causing vomiting and purging. It is excreted by the kidneys, and stains the urine yellow.

THERAPEUTICS.

It is used as an antiparasitic in ringworm, and to excite healthy inflammation in chronic cutaneous diseases, especially psoriasis and acne rosacea. Pigmentum Chrysarobini, B. P. C. (chrysarobin, 1; solution of gutta percha, 9) is more cleanly than the ointment and does not stain the clothes. Chrysarobin has also been given internally for skin diseases, but as it is so irritating this practice is not advisable.

CHAULMOOGRA OIL.

Oleum Chaulmoograe. *Synonym.* Gynocardia oil. The fatty oil expressed from the seeds of *Taraktogenos Kurzii.*

CHARACTERS.—A brownish yellow oil or soft fat, with characteristic odour and somewhat acrid taste. Soluble in ether, chloroform, or alcohol.

Composition.—Its chief constituent is gynocardic acid, a yellow, oily body, with a burning taste.

Oleum Chaulmoograe was called Oleum Gynocardiae in B. P. 1898.

Dose, 5 to 10 m. 3 to 6 decimils—increased to ½ to 1 fl. dr.—2 to 4 mils. It is best given in capsules.

Preparation.

Unguentum Chaulmoogræ. - Gynocardia oil, 1; hard paraffin, 4; soft paraffin, 5.

ACTION AND THERAPEUTICS.

The active properties of this oil have been ascribed to gynocardic acid. Externally the oil is a powerful rubefacient, and may cause great pain when applied to raw places, but an ointment (3 fl. dr. to 1 fl. oz. of lanolin) has been used for very chronic psoriasis. Internally it is a gastro-intestinal irritant. It has been much praised for leprosy, in which disease it is applied externally and given internally. The stomach may be trained to tolerate large doses. It certainly does not cure leprosy, but many consider that it retards the disease.

GROUP XVI.

Vegetable Drugs used only as Colouring Agents.

Red Sanders-wood, Sappan.

RED SANDERS-WOOD.

Pterocarpi Lignum.—Red sanders-wood. *Synonym.* Red sandal wood. The heart-wood of *Pterocarpus santalinus.* Ceylon.

CHARACTERS. — Dense, heavy logs; dark brown externally, internally deep blood-red. Chips deep reddish brown. *Resembling sanders-wood.*- Logwood, which is less dense.

COMPOSITION.—The chief constituent is a blood-red crystalline principle, santalic acid or santalin.

Sanders-wood is contained in Tinctura Lavandulæ Composita.

ACTION AND THERAPEUTICS.

Sanders-wood is used to colour preparations.

SAPPAN.

Sappan. —The heart-wood of *Cæsalpinia sappan*.

CHARACTERS. In hard, heavy sections of variable size, or in orange red chips. The transverse section shows well marked concentric rings and numerous rays.

Preparation

Decoctum Sappan. Sappan, 50; cinnamon bark, 10; water, to 1000.

Dose, ½ to 2 fl. oz. —15 to 60 mils.

ACTION AND USES.

Before the introduction of aniline dyes sappan wood was used largely to dye fabrics red. It is also used to make red ink. It contains tannin, and is therefore used in pharmacy to colour mixtures red, especially when an astringent effect is desired. It is used chiefly in India and the East Indies.

GROUP XVII.

Vegetable substances whose action is mechanical.

Cotton, Collodion, Oil of Theobroma, Quillaia, Starch.

COTTON.

Gossypium. —Cotton. *Synonym.*—Cotton Wool. The hairs of the seeds of *Gossypium herbaceum*, and of other cultivated species of *Gossypium*, from which the fatty matter has been removed. This is commonly called "Absorbent Cotton Wool." Ordinary cotton wool is called "Non-Absorbent." It contains 10 per cent. of fixed oil.

From gossypium is made—

Pyroxylinum. —Pyroxylin or Dinitrocellulose, $C_6H_8(NO_2)_2O_5$. Gossypium is immersed in a mixture of sulphuric and nitric acids, and then drained and dried. Soluble in a mixture of ether and alcohol (90 per cent.). Resembles cotton wool but is harsher to touch. Highly inflammable.

Preparations.

1. Collodium.—Pyroxylin, 21; dissolved in ether, 750; and alcohol (90 per cent.), 250.

2. Collodium Flexile.—Collodion, 48; Canad balsam, 2; castor oil, 1.

3. Collodium Vesicans. — Pyroxylin, 25 cochineal, 10; liquor epispasticus to produce 1000.

ACTION AND THERAPEUTICS.

The use of cotton wool is well known. Cotton wool, lint, and gauze are frequently medicated, *e.g.* Sal Alembroth, 1 or ½ per cent.; mercuric chloride 0·1 per cent.; boric acid, 10 per cent.; carbolic acid 5 per cent; iodoform, 10 or 20 per cent.; mercury and zinc cyanide, 3 per cent. All these gauzes are in the B. P. C.

Pyroxylin is only used to make collodion.

Collodion, when painted on the skin, rapidly dries from evaporation of the ether, and covers the skin with a thin protective film. Collodium Flexile has the same properties, but it does not crack, as collodion often does. These preparations are protective to small wounds, and are used after slight operations. If the end of the urethra or prepuce is at night closed with collodion, nocturnal incontinence may sometimes be cured.

OIL OF THEOBROMA.

Oleum Theobromatis. *Synonym.*—Cacao butter. A solid fat obtained by expression from the seeds of *Theobroma cacao.* Growing in Demerara and Mexico. Chocolate is prepared from the roasted kernels of these seeds by the addition of sugar and vanilla. Cocoa is prepared from them by partly removing the oil of theobroma by pressure and then roasting and grinding the kernels.

CHARACTERS.—Is of the consistency of tallow; yellowish, with chocolate-like odour. Taste bland and agreeable. Fracture clean. Does not become rancid on exposure to air. Melts at 30° to 33°C.

COMPOSITION.—The chief constituents are—(1) *Stearin.* (2) A little olein. (3) An alkaloid, theobromine, $C_7H_8N_4O_2$, for the action of which see p. 407.

Oil of theobroma is contained in all Suppositoria except those of glycerin.

ACTION AND THERAPEUTICS.

It is only used to make suppositories.

QUILLAIA BARK.

Quillaiæ Cortex. *Synonyms.* Panama bark; Soap bark. The dried inner part of the bark of the tree *Quillaja saponaria.*

CHARACTERS. Large flat pieces, 3 to 8 millimetres thick, of varying length and width. Outer surface brown, inner white. It imparts a soapy character to cold water, and is used to diffuse oily liquids through water.

COMPOSITION.—The chief constituent is saponin, a glucoside (*see* p. 466).

Quillaia bark is used to emulsify the tar in Liquor Pici Carbonis when it is diluted (*see* p. 530).

Preparation.

Tinctura Quillaiæ.—Bark, 1; alcohol (60 per cent.), 20. Percolate.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

ACTION AND THERAPEUTICS.

Saponin is contained in many plants, but that derived from some plants is more poisonous than that derived from others. The more poisonous varieties are called sapotoxins. All saponins form a frothy solution in water, and hence tincture of quillaia is largely employed to make a lather for shampooing, and might be used to aid the diffusion of oils and other insoluble bodies, but for the fact that saponin is a powerful gastro-intestinal irritant. If saponin is absorbed, in its excretion it irritates the bronchial mucous membrane. Hence the use of senega (*see* p. 465) as an expectorant. Saponin is a general protoplasmic poison, and therefore on all grounds the use of drugs containing it is not desirable.

STARCH.

Amylum.—Starch $(C_6H_{10}O_5)_n$. The starch procure from the grains of wheat, *Triticum sativum*; maize, *Ze Mays*; rice, *Oryza sativa*.

CHARACTERS.—Well known.

Preparation.

Glycerinum Amyli.—Starch, 2; glycerin, 13 water, 3.

Starch is contained in Pulvis Tragacanthæ Compositus.

ACTION AND THERAPEUTICS.

Starch is chiefly employed for its mechanical properties, on account of which it is used as a basis for dusting powders and insufflations. Mucilage of starch, which is made by triturating 120 gr. (8 grms.) of starch with 10 fl. oz. (300 mils) of water, gradually added and then boiled and stirred for a few minutes, may be used as a basis for ointments, and to suspend insoluble powders or oils; it is very handy as a basis for enemata, but does not keep well and is therefore not suitable as a vehicle for a mixture.

GROUP XVIII.

Vegetable Substance whose Action is Not Known.

Guaiacum.

GUAIACUM WOOD.

Guaiaci Lignum. *Synonym.*—Lignum vitæ. The heart-wood of *Guaiacum officinale* or of *Guaiacum sanctum*. West Indies.

CHARACTERS.—Dark greenish brown, dense, hard, and heavier than water. Taste acrid and aromatic. Odour, if rubbed or heated, faintly aromatic.

COMPOSITION.—The chief constituent is the resin, 20 to 25 per cent. (*q.v.*).

Guaiaci Resina.—Guaiacum Resin. The resin obtained from the stem of *Guaiacum officinale* or of *Guaiacum sanctum*.

CHARACTERS.—Usually in large masses, occasionally in roundish tears. Surface brown or greenish brown, covered, after exposure, with a greenish powder. Fracture clean and glassy. Odour balsamic. When chewed gives acrid sensation in the throat. An alcoholic solution strikes a clear blue colour when applied to the inner surface of a potato (fresh protoplasm), or when treated with tincture of iron. Guaiacum resin on dry distillation yields amongst other substances cresol and *guaiacol*, also found in creosote (*see* pp. 342 and 343). *Resembling guaiacum resin.* Myrrh, scammony, benzoin, aloes, and resin, but these have no green tinge.

COMPOSITION.—The chief constituents are three resins: Guaiaconic acid, $C_{20}H_{24}O_5$ (70 per cent.); guaiac acid, resembling benzoic acid; and guaiaretic acid. These are insoluble in water, soluble in alkalies, but precipitated on neutralization.

INCOMPATIBLES.—Mineral acids, spirit of nitrous ether.

Dose, 5 to 15 gr.—3 to 10 decigrms.

Preparations.

1. **Mistura Guaiaci.**—Guaiacum resin, 25; sugar, 25; tragacanth, 5 (to suspend the resin); cinnamon water, 1000. (The resin very quickly falls.

Dose, ½ to 1 fl. oz.—15 to 30 mils.

2. **Tinctura Guaiaci Ammoniata.**—Guaiacum resin, 200; oil of nutmeg, 3; oil of lemon, 2; strong solution of ammonia, 75; alcohol (90 per cent.), to make 1000. Macerate. As the resin is precipitated on dilution of the ammonia it must be suspended by adding mucilage or yolk of egg.

Dose, ½ to 1 fl. dr.—2 to 4 mils.

3. **Trochiscus Guaiaci Resinæ.**—0.2 grm. or 3 gr. in each, with a fruit basis.

4. **Pilula Hydrargyri Subchloridi Composita.**—1 in 2½ (*see* p. 212).

ACTION.

External.—None.

Internal.—Guaiacum resin gives rise to an acrid feeling in the throat and a sensation of heat in the epigastrium. It increases the secretions and mov ments of the intestine and stomach. Large dos are gastro intestinal irritants, causing vomiting an purging. It reflexly stimulates the heart.

THERAPEUTICS.

Internal. Guaiacum resin is so nasty and it value so doubtful that it is rarely ordered. It used empirically, sometimes successfully, for chroni sore throat, especially if the subject has had syphilis The mixture is said to be a more efficacious preparation than the tincture. Thirty grains (2 grms. of the powder itself may be placed on the back o the throat and swallowed, but the lozenge is to b preferred. Guaiacum is a mild purgative, and i has been given as a pill in chronic constipation this property accounts for its presence in compoun calomel pills. It has been strongly recommende as a means of warding off attacks of gout. For thi purpose 12 grams (8 decigrms.) of the powdere resin may be taken in a cachet for an indefinit period, even several years. Some follow it by a draught of effervescing citrate of lithium. It was formerly employed for chronic rheumatism.

SECTION II. PHARMACOPŒIAL SUBSTANCES DERIVED FROM THE ANIMAL KINGDOM.

SUET.

Sevum Præparatum. The purified internal fat of the abdomen of the sheep, *Ovis aries.*

COMPOSITION.—(1) Olein, 30 per cent. (2) Palmitin. (3) Stearin.

Suet is contained in Unguentum Hydrargyri.

Sevum Benzoatum. Benzoated Suet. Benzoin, 3 : prepared suet, 100. Melt the suet, add the benzoin, keep at 60° for one hour. Strain and stir till nearly cold.

In India benzoated suet should be employed in making the official preparations for which benzoated lard (Adeps Benzoatus) is directed to be used (*see* p. 648).

CURD SOAP.

Sapo Animalis.—Curd Soap. Soap made with sodium hydroxide and a purified animal fat consisting principally of stearin. It is chiefly stearate of sodium, but contains some palmitate of sodium and about 30 per cent. of water.

Curd soap is contained in Extractum Colocynthidis Compositum and Linimentum Potassii Iodidi cum Sapone.

ACTION AND THERAPEUTICS.

Curd soap is employed as a basis, and, like hard soap (*see* p. 604), may be used for medicated soaps.

ADEPS LANÆ.

Adeps Lanæ.—Wool Fat. *Synonym* Anhydrous Lanolin. The purified fat of sheep's wool freed from water. For Adeps Præparatus *see* p. 665.

CHARACTERS.—Semi-transparent, pale yellow, tenacious body. Ignited it burns with a sooty flame. Melts about 40 C. Odour faintly like sheep's wool. *Solubility.*—Freely in chloroform and in ether, partially in alcohol. Insoluble in water, but on vigorous stirring takes up 1¾ times its own weight.

Adeps Lanæ is contained in Unguentum Hamamelidis and Emplastrum Cantharidini.

Preparation.

Unguentum Lanæ Compositum. Prepared lard, 40; wool fat, 40; paraffin ointment, 20. *Synonym.*—Emollient Ointment.

In India prepared suet should be used instead of prepared lard.

Adeps Lanæ Hydrosus. Hydrous wool fat. *Synonym.*—Lanolin.

SOURCE.—Incorporate 3 of water with 7 of wool fat, and melt in a warm mortar.

CHARACTERS.—Opaque, very pale yellow, softer than wool fat. On heating it separates into an upper oily and a lower aqueous layer. Glycerin abstracts the water.

ACTION AND THERAPEUTICS.

Hydrous wool fat when gently rubbed on the skin is more quickly absorbed than most fats; hence it is a useful basis if we wish to administer substances as, for example, mercury by inunction, or if we want an ointment to be absorbed.

Milk, Artificial Human.—(Not official.)

PREPARATION.—Add 3·5 per cent. of Pulvis Pancreaticus Co. (B. P. C.) to sugar of milk, forming "milk powder." Triturate 6·5 of milk powder with 62 of water, add the mixture to 62 of fresh cow's milk enriched by the addition of 15 of fresh cream. Immerse the bottle containing the whole in water heated to 38°C. for 15 minutes, then heat the mixture quickly to boiling point and allow it to immediately cool to the body temperature. Humanized milk should be prepared immediately before use.

ACTION AND THERAPEUTICS.

Artificial human milk is invaluable as a food for infants whose mothers cannot suckle them. Many cases of infantile diarrhœa, indigestion, and sickness can be cured by substituting this milk for the usual milk and water or infants' food. Some large dairy firms supply it, but it is cheaper to make it at home, and the above directions are easily carried out. When bought it is often sterilized and sold in air-tight bottles. It should be remembered that a long continued diet of sterilized milk may, in children, cause scurvy rickets.

Milk, Peptonized.—(Not official.)

PREPARATION.—Take 25 grs. of Pulvis Pancreaticus Co. (B. P. C.), commonly known as peptonizing powder, and add it to 5 fl. oz. of tepid water in a flask, add to this a pint of milk previously warmed to 38°C., at which temperature the mixture should be maintained for half an hour, after this the flask should be transferred to a cold place until required for use. Peptonized milk should not be used after it has been kept more than 24 hours or after it has acquired a bitter taste. If metric quantities are used take 1·5 grms. of the powder, 125 mils water, and 500 mils milk.

ACTION AND THERAPEUTICS.

Peptonized milk is used in many conditions in which it is thought that the gastric digestion is too feeble to digest ordinary milk, or in which it is desired, as sometimes, for instance, in typhoid fever, to avoid the curdling of milk in the stomach. Milk or milk and egg should always be peptonized before being introduced into an enema.

Koumiss, or Kumyss.—(Not official.)

This is largely drunk by the Tartars, who prepare it by fermenting mare's milk. It may be made by dissolving ½ oz. of grape sugar in 4 fl. oz. of water and 20 gr. of yeast in 4 fl. oz. of cow's milk. Pour both into a quart bottle, which is then filled up with milk, corked, wired, and put in a cool place and frequently shaken for four days.

USES.

It contains a little alcohol an [illegible] extremely useful as a stimulant food in convalescence, in phthisis, and other conditions of exhaustion. It is often borne by the stomach when all other food is vomited. Several dairy firms sell it.

SUGAR OF MILK.

Saccharum Lactis. Sugar of milk. *Synonym.* Lactose, $C_{12}H_{22}O_{11},H_2O$. A crystallized sugar obtained from the whey of milk.

CHARACTERS.—Crystals or crystalline masses, greyish white, translucent, hard; scentless; faintly sweet; gritty when chewed.

ACTION AND THERAPEUTICS.

Sugar of milk is used as a vehicle for the trituration of powders, because being very hard it thoroughly divides them, and also it is but slightly deliquescent. For these reasons it is used as a diluent to get extracts to the required strength. It is employed to sweeten infants' food. As most patients suffering from fever take milk diet, which is almost a starvation diet, and carbohydrates are particularly valuable in fever, for they are easily digested foods and spare the proteins of the body, ordinary milk may, in fever, be fortified by the addition of one, or if it does not disagree, two ounces of lactose to each pint.

OX GALL.

Fel Bovinum Purificatum. Purified Ox Bile The purified gall of the ox

SOURCE.—Evaporate fresh ox bile to one quarter its bulk. Wash thoroughly with alcohol (90 per cent.), distil off the alcohol. Evaporate what remains to the consistence of an extract.

CHARACTERS. Yellowish green. Soluble in water and in alcohol. Taste partly sweet, partly bitter.

Dose, 5 to 15 gr. 3 to 10 decigrms.

ACTION AND THERAPEUTICS.

Ox gall has been used as a cholagogue purgative in cases of constipation in which the pale colour of the faeces indicates a deficient secretion of bile. An enema of 20 gr. (12 decigrms.) or more of it dissolved in an ounce or two of water is very useful in cases of impacted faeces, in which the rectum is so full that there is not sufficient room for a larger enema. It is a true cholagogue, for after absorption it passes to the liver, the secretion of which it considerably increases. Bile is an antitoxin; thus the bile of venomous snakes is antidotal to their poison.

GELATIN.

Gelatinum. The air dried product of the action of boiling water on skin, tendons, ligaments, and bones.

CHARACTERS. In translucent, almost colourless sheets or shreds. The solution in hot water is colourless and inodorous; it solidifies to a jelly on cooling. It is insoluble in alcohol or ether. Its aqueous solution is precipitated by tannin.

Gelatin is a constituent of Suppositoria Glycerini and all Lamellæ.

ACTION AND THERAPEUTICS.

Gelatin is a hæmostatic, and has been given by the injection of a sterilized solution in normal saline fluid into the cellular tissue of the axilla in cases of hæmaturia, purpura, and to promote the formation of clot in aneurysms. Two hundred and fifty c.c. of a 1 per cent. solution may be injected every fourth day, or less of a 2 per cent. solution. The treatment is not to be recommended, for it may cause much pain, it often fails to stop bleeding or to cure the aneurysm, and it may cause hæmaturia. Gelatin often contains tetanus bacilli due to contamination from dirty hides, and fatal tetanus has frequently followed the injection of imperfectly sterilized gelatin; sometimes fatal symptoms resembling tetanus have resulted from the use of sterilized gelatin, these have been ascribed to emboli in the spinal cord. Gelatin is a useful basis for suppositories, pessaries, bougies, discs, gelatin capsules and lozenges, and as a coating for pills. Glycogelatin B. P. C. (gelatin, glycerin, sugar citric acid, oil of lemon, orange flower water, carmine and water) is an excellent basis for throat pastilles. Each should weigh 30 gr. (2 grms.) Almost any drug may be incorporated in such pastilles. Medicated gelatin is often melted and painted on the skin in cutaneous affections.

LARD.

Adeps Præparatus. Lard. The purified fat of the hog, *Sus scrofa.*

COMPOSITION.—(1) Olein, 60 per cent. (2) Stearin. (3) Palmitin.

Lard is contained in many ointments.

In India prepared suet should be employed in making the official preparations for which prepared lard is directed to be used.

Preparation.

Adeps Benzoatus. — Prepared lard, 1000: Benzoin in coarse powder, 30.

In India benzoated suet should be employed in making the official preparations for which benzoated lard is directed to be used.

ACTION AND THERAPEUTICS.

Lard is an emollient, and is used as a basis for ointments when it is wished that the active ingredient should be absorbed, for lard melts at the temperature of the body, especially if bandaged on. The benzoated variety has the advantage of not quickly turning rancid.

PEPSIN.

Pepsinum.—An enzyme obtained from the fresh and healthy stomach of a pig, sheep, or calf.

CHARACTERS.—A light yellow-brown powder, or pale yellow translucent grains or scales. Odour faint. Taste slightly saline. Very sparingly soluble in water or alcohol.

TEST.—Triturate 0·25 grm. pepsin with 1 grm. sodium chloride, add acidified water 1000 (0·65 per cent. of hydrochloric acid in water). Put in a flask 20 millilitres of the pepsin solution, add 12·5 grms. of freshly prepared coagulated white of egg rubbed through a fine sieve, triturate with 100 millilitres of acidified water Keep the flask in a water bath at 41 C. for 6 hours. The white of egg should be dissolved, the solution being faintly opalescent. This shows that the pepsin has in 6 hours dissolved 2500 times its weight of coagulated white of egg.

Dose, 5 to 10 gr.—3 to 6 decigrms.

Preparation.

Glycerinum Pepsini. — Pepsin, 100: hydrochloric acid, 11·5; glycerin, 600; distilled water to make 1000. *Strength.*—1 fl. dr. represents 5·5 gr. of pepsin or 10 mils contain 1 grm.

Dose, 1 to 2 fl. dr.—4 to 8 mils.

ACTION AND THERAPEUTICS.

Pepsin may be given to help gastric digestion in those in whom from old age or long illness the secretion of gastric juice is deficient. Thus it may be useful in convalescence from acute illnesses or in cases of cancer of the stomach, but it cannot aid the digestion of fatty or carbohydrate food. It should be given directly after meals, and followed by a dose of hydrochloric acid in the proportion mentioned in the test. The pepsin should be tested before use, as many samples are inert. It is best given as Glycerinum Pepsini without additional hydrochloric acid.

Pepsin may be used to predigest albuminous food, either for administration by the mouth or the rectum. This is better than giving pepsin internally, for morbid processes may be going on in the stomach which prevent digestion. For predigestion Pulvis Pancreaticus Co. B. P. C. or Liquor Pancreatis (*q.v.*) is more reliable than pepsin. Both should be employed with judgment, for there is a likelihood that if artificial digestion be used too long the digestive functions of the stomach may atrophy. The rectum has no powers of digestion, and therefore many nutrient enemata and suppositories are predigested, but this is useless, for we now know that hardly anything but sugar can be absorbed from the rectum (*see* p. 616).

Preparations containing (*a*) pepsin with pancreatin and (*b*) pepsin with alkaline salts of bismuth are often ordered, but it must be remembered that in the presence of an acid pepsin destroys pancreatin, that in neutral solution pancreatin destroys pepsin, and that pepsin is immediately destroyed by alkalies.

The following directions for peptonizing meat may be followed. Take one pound of lean meat, pulp it finely, add six times its weight of water containing 0·2 per cent. of hydrochloric acid and 120 grains of pepsin. Digest at 47° C. in a porcelain digester for five or six hours with frequent stirring. Then neutralize with sodium carbonate, boil and filter. Evaporate the filtrate on a water-bath till it is of the consistency of a soft extract.

Peptonized meat suppositories are used, but no nourishment can be absorbed from them and they irritate the rectum.

PANCREATIC SOLUTION.

Liquor Pancreatis. A solution of the digestive principles of the fresh pancreas of the pig. It is most active when the animal from which it has been obtained has been fed shortly before being killed.

SOURCE.—Mix 250 millilitres alcohol (90 per cent.) and 200 millilitres of glycerin with water to produce 1000. Macerate 250 grms. of pancreas in this for 7 days.

TEST.—If 3 millilitres with 0·2 grm. of sodium bicarbonate and 20 millilitres of water be added to 80 millilitres of milk, and the mixture kept at 45°C. for 1 hr., coagulation should no longer occur on the addition of nitric acid.

Dose, 1 to 2 fl. dr.- 4 to 8 mils.

ACTION AND THERAPEUTICS.

Liquor pancreatis in the presence of alkalis has the power of converting starch into sugar, albumen and fibrin into peptones, and first curdling and then peptonizing milk. It will not act in an acid medium or above 47 C. The directions for peptonizing milk are given on p. 662. The Pulvis Pancreaticus Co. B. P. C. is a more convenient preparation than the Liquor as it contains sodium bicarbonate (pancreatin, 20 ; sodium bicarbonate, 80). It or liquor pancreatis and sodium bicarbonate used in the same proportions as in peptonizing milk will predigest farinaceous foods. It and bicarbonate of sodium or other preparations of pancreas are often taken by the mouth one to two hours after meals, but they are certainly useless if there is present any acid gastric juice to neutralize the alkali.

Many pancreatized and peptonized foods are on the market, *e.g.* pancreatized emulsion of fat, pancreatized farinaceous food, peptonized chicken and beef jelly. These are often useful for those whose digestions are weak. Holadin capsules contain extract of the entire pancreas, and are given when it is suspected that the activity of the pancreas is deficient. It is supposed that the capsule is not dissolved until it reaches the alkaline contents of the intestine. The treatment of diabetes by preparations of pancreas has not proved successful.

Trypsin.—(Not official.) The ferment or enzyme formed from the zymogen trypsinogen secreted by the pancreas.

CHARACTERS. A white powder, changing proteins into peptones in an alkaline medium. It always contains some amylopsin and inert matter.

Dose, 3 to 10 gr.—2 to 6 decigrms.

A 5 to 10 per cent. cream, or suppositories, or pessaries, or solution in dilute glycerin, all made alkaline with sodium bicarbonate, have been used as an application to ulcerated malignant growths, because it has been suggested that the growth of cancer cells is due to an enzyme which acts in an acid medium, and therefore trypsin, which only acts in an alkaline medium, will neutralize this, but the benefit is doubtful. This suggestion has been carried further and it has been supposed that cancer enzyme can only act because in cancerous patients pancreatic secretion is deficient, hence trypsin with an alkali has been given internally in cancer but there is no proof that this does any good.

THYROID GLAND.

Thyroideum Siccum.—Dry Thyroid. A powder prepared from the fresh and healthy thyroid gland of the sheep.

SOURCE. Remove the fat and connective tissue directly the sheep is killed. Reject cystic, hypertrophied, or otherwise abnormal glands. Mince. Dry at 30°C. to 40°C. Powder the dried product. Remove all fat by washing with petroleum spirit and again dry.

CHARACTERS.—Light dull brown powder with faint meat-like odour and taste, and free from odour of putrescence. Liable to become damp and then deteriorates.

COMPOSITION. The chief constituent is a protein, which exists in the colloid matter and is called thyreoglobulin which by artificial digestion is split up into albumoses and a non-protein body, the active principle, called thyroiodin, which contains 9.3 per cent. of iodine, 0.5 per cent. of phosphorus, and is rich in nitrogen.

Dose, ½ to 4 gr. 3 to 25 centigrms. In cachets.

ACTION.

Circulation.– Thyroid administered to mar increases considerably the rate of the pulse, cause palpitation, enfeebles the cardiac beat, and makes th skin flushed and moist. Experiments on animal have failed to reveal the precise cause of this. Th blood-pressure falls when a decoction of the gland i injected: the fall is vaso-motor, for the heart is no affected. Ordinary doses produce no effect on th blood except an increase in the number of lymphocytes.

Excretion.—The active constituents of thyroi gland are probably excreted entirely through th kidneys. Large doses may cause diarrhœa.

Metabolism.– The administration of thyroi leads to a greatly increased oxidation of all th tissues, consequently an excess of urea, uric aci xanthin bases, and phosphates are excreted in th urine, and more carbonic acid by the lungs. I follows that large doses of thyroid reduce the bod weight. One sixth of the loss comes from protein and five sixths from excessive oxidation of fats.

Kidney.—The quantity of urine is increased b giving thyroid, which may cause sugar and iodine i the form of iodides to appear in the urine.

Nervous system.—Occasionally a fine tremo restlessness, and insomnia are caused by large dose

THERAPEUTICS.

It is known that human beings whose thyroi is excised become myxœdematous, and that a sufferers from myxœdema have atrophied thyroi glands. If a preparation of sheep's thyroid is give to patients suffering from myxœdema, all the symptoms disappear, usually in about six weeks, althoug the patient's thyroid remains atrophied. Th effect is as striking as anything in medicine. It i best to begin with 5 gr. thrice a day, to gradually increase the dose till 10 gr are given, and when all the symptoms have disappeared it will be necessary for about 10 gr. to be taken twice a week for the rest of the patient's life, to prevent recurrence. When the treatment was first introduced the glands were eaten, or transplanted under the skin, or the extract was administered subcutaneously; but equally good results are obtained by giving the liquor or the powder by the mouth; tablets of the powder are very convenient and much used. A diminution of certain goitres follows the giving of thyroid, but it is useless in exophthalmic goitre. Cretinism is also marvellously benefited, both mentally and bodily, by thyroid preparations, especially if given early in the patient's life. A few cases of imbecility in children, a few of climacteric insanity, and a few of tetany have been much improved by thyroid. Chronic psoriasis, which has resisted all other treatment, often disappears if the patient is put to bed and takes daily enough of thyroid preparations to keep him on the brink of poisoning by them, but unfortunately the disease often returns when the treatment is discontinued.

Thyroid preparations have been used for obesity, but the practice is not to be recommended. They must be carefully given to those suffering from cardiac disorder. A preparation called Iodothyrine, which contains the active principle of the gland, has been used lately.

Poisoning.—An overdose of a thyroid preparation causes an exaggeration of the effects already described. The most evident are a rapid pulse, slight pyrexia, headache, nausea, diarrhœa, restlessness, pains in the limbs, pruritus, and rarely delirium. These symptoms are termed "Thyroidism"; it is said that the liability to them is lessened if arsenic be taken. If large doses be given to monkeys for a long period, a condition termed 'Chronic Thyroidism' i produced. The symptoms of it are emaciation, muscular weakness, paresis, some alopecia, erection o some of the hairs on the head, proptosis, dilatation of pupils, widening of palpebral fissure, and deat from asthenia. In some respects these monkey resemble patients suffering from exophthalmi goitre.

Extracts of many other organs, *e.g.* bone-marro and thymus (Thyminic acid known as solurol, derivative of the nucleic acid present in thymus is said, by possessing an affinity for uric acid, t prevent its deposition, and is therefore used i gout. Dose, 5 to 10 gr., usually given in a tablet) have been employed in medicine, but the only one that are of any use are those of the suprarenal an pituitary.

SUPRARENAL EXTRACT.

Adrenalinum. Adrenalin or Lævo-methylamino-ethanol-catechol, $C_9H_{13}NO_3$ (*Synonyms.*—Adrenine, Epinephrine, and Hemisine).

SOURCE.—Obtained from the suprarenal glands animals. It exists only in the medulla of the suprarenal glan

CHARACTERS.—A light brown or nearly white, microcrystalline powder. Very slightly soluble in water; almos insoluble in alcohol, in ether, and in chloroform.

Preparation.

Liquor Adrenalini Hydrochloricus. Adrenalin, 1; chloroform, 5; sodium chloride, 9; dilut hydrochloric acid, 3; distilled water to 1000. To b preserved in amber glass bottles.

Dose, 10 to 30 m. 6 to 18 decimils.

ACTION.

External.—Adrenalin has no action on the unbroken skin.

Internal.—It is probably so diluted by th gastro-intestinal contents that it does not affec the mucous membrane of the stomach and intestines, nor is it absorbed from these The gastric contents have no effect on adrenalin. It acts very quickly, both generally when injected into vessels or subcutaneously, and locally when applied directly to serous membranes and many mucous membranes, *e.g.* that of the nose.

Heart.---The heart is **slowed** from stimulation of the vagal centre in the medulla by the increased blood-pressure, but sometimes it is first accelerated for a short while from stimulation of the accelerator nerve-fibres in the heart; the **force of the systole is increased** by direct action on the cardiac muscle. These effects are the same as, but much more powerful than, those of digitalis, but they only last a short while.

Vessels.—Most of the small arteries of the body are **constricted** by direct action of adrenalin on the nerve terminations in their muscular coat when it is in the blood; because of this and the cardiac action the blood pressure **rises** considerably. Here, again, adrenalin resembles digitalis. Even large doses do not affect the vessels of the lungs, heart, and brain; the constricting effect is most striking in the splanchnic area. This constriction is often very marked at the point of local application, *e.g.* when adrenalin is applied to mucous membrane of the nose.

Glands.—Like pilocarpine, adrenalin powerfully excites secretion by stimulating nerve terminations. It acts chiefly on the **salivary glands** and those of the mouth; hardly at all on the sweat glands. Atropine is directly antagonistic to it. Adrenalin has a special action on the liver, producing **glycosuria**, due to the rapid conversion of glycogen into glucose.

Unstriped Muscle. Much of this, besides that of the arterioles, is **contracted** by the action of adrenalin on nerve terminations, *e.g.* that of uterus, vagina, vas deferens, vesiculi seminales. The same peripheral effect leads to dilatation of the pupils, retraction the nictitating membrane, and protrusion of the ey The ileo-colic sphincter is contracted, but the re of the intestine is dilated.

Adrenalin has a specific stimulant effect on t terminations of the nerves of the sympathetic syster and so produces in general the same effects stimulation of the sympathetic nerves. Adrenal is destroyed in the body, so that its effects rapid pass off.

THERAPEUTICS.

Because of its powerful local vaso-constricto action an aqueous solution of adrenalin—of strength of 1 in 1000—is locally applied as a hæm static with great advantage in many conditions suc as epistaxis, hæmorrhage from the uterus, befo operations on adenoids, turbinated bones or pile For these purposes it may be used as gauze plug soaked in the 1 in 1000 solution, or as a spray (1 i 2500), or as a suppository (10 ♏ of 1 in 1000 solutio in each). It may be introduced into the bladder befor operations on it, or again it may be given for hæma temesis (5 to 30 ♏, 3 to 18 decimils, of 1 in 100 solution), but it is of little use here as it is muc diluted by the gastric contents. Applied with cocain or eucaine it may be used for painless, bloodless operations on the eye and other parts (*see* pp. 431 434 Adrenalin has very great power to contract th uterus, whether pregnant or non-pregnant, and may be used for the interior of the uterus in th same way as for the nose.

Thirty minims of a 1-in-1000 solution o adrenalin may be injected subcutaneously in cases o shock or any form of sudden cardiac failure, for i animals the heart may be completely resuscitate by this method even when the circulation has appa rently ceased, but clinically adrenalin is of less us as a cardiac stimulant than might be expected, for its effects pass off very quickly, even if as is sometimes done, it is given intravenously. As a circulatory restorative pituitary extract is clinically far superior as its effects last longer. Occasionally subcutaneous abscesses follow subcutaneous injection. This can not always be avoided, but some preparation sold in sealed sterilized phials (*e.g.* Hemisine) should be used. Hemisine is standardized physiologically by observation of its effects on blood pressure.

Preparations of suprarenal gland have been given for Addison's disease, but their value is very uncertain. Certainly often they are of no use. As adrenalin is not absorbed from the gastro-intestinal tract it can only be given for its remote effects hypodermically or intravenously.

Adrenalin is one of the most efficacious drugs for stopping a paroxysm of asthma. Five or ten minims of the Liquor injected subcutaneously will often do this in a few seconds.

TOXICOLOGY.

Fatal doses of adrenalin lead to two varieties of changes seen *post mortem.* Its action on the blood pressure leads to congestion of the viscera, hæmorrhages and serous effusion. These changes are well seen in the kidneys, liver, and lungs. Their occurrence in the last-named causes œdema of the lungs and filling of the air vesicles with blood; hence the animal dies of asphyxia. Consequently adrenalin should never be given for hæmoptysis. The other toxic changes, seen chiefly in the cells of the liver and kidneys, are due to the fact that adrenalin is a protoplasmic poison. Owing to the action on the liver, there is a great fall in the output of urea.

Pituitary Extract.—(Not official.)

This is prepared from the posterior or infundibular lobe of the pituitary body.

DOSE.—Usually given subcutaneously in doses of 1 c.c., corresponding to 3 grains of the posterior lobe. Sterilized solutions in glass capsules, called vaporoles, containing 1 c.c. and 0·5 c.c. in each, are sold.

ACTION.

Pituitary extract probably has little or no effect when given by mouth, and the following account applies to subcutaneous or intramuscular injection When given thus it acts so quickly that it is rarely necessary to give it intravenously.

Circulatory System.—The heart is slowed partly from the effect on the vagus, partly from that on its muscle. There is a great rise of blood-pressure due somewhat to the cardiac effect, but chiefly because the drug constricts arterioles by acting on their muscular coat.

Kidneys.—The renal arterioles are not constricted but dilated, and therefore there is an abundant secretion of urine.

Pituitary extract has a remarkable effect in increasing the secretion of milk.

Uterus.—Pituitary extract causes this to contract strongly from a direct effect on the muscle.

Intestines.—The muscle of these, too, is stimulated, but to a less extent.

THERAPEUTICS.

Pituitary extract is an admirable circulatory stimulant, acting within a minute or two of injection. It is of great use in cardiac failure during severe operations, and to a less extent in severe fevers, *e.g.*, pneumonia when the pulse is failing; indeed, it may be used for cardiac failure due to any cause. The good effect soon passes off, but it lasts much longer than that due to adrenalin. It may be tried as a diuretic, but does not act so well when the kidneys are diseased as when they are healthy. It has been used instead of ergot to produce uterine contraction whenever that is required, and is occasionally very useful in severe constipation and to get the bowels to act after operations. It has also been given to promote the secretion of milk. Its action suggests that it may prove to be of value in exophthalmic goitre. It does not benefit sufferers from acromegaly. Paralysis agitans and osteomalacia are both said to be improved by pituitary extract. If a second injection is given, it should be several hours after the first, for experiments show that a second injection quickly following a first often produces collapse.

The extract, which is previously standardized physiologically by its action on the uterus, is a fluid of which the dose is 0·5 to 1·0 c.c. injected subcutaneously. It is sold in hermetically sealed bulbs called "Vaporoles," each containing a single dose. As only the infundibular part of the gland is used it is ordered as "Vaporole Infundin."

SPERMACETI.

Cetaceum. Spermaceti. A solid wax obtained from the sperm whale, *Physeter macrocephalus.*

Characters.—Crystalline, pearly white, glistening, translucent masses with little taste or odour. *Solubility.* Not in water, but soluble in ether, chloroform, or boiling alcohol

Composition.—It is cetylic alcohol, $C_{16}H_{33}OH$, in combination with palmitic acid, $HC_{16}H_{31}O_2$, forming a fat, cetin, $C_{16}H_{33},C_{16}H_{31}O_2$.

Preparation.

Unguentum Cetacei.—Spermaceti, 20; white beeswax, 8; liquid paraffin, 72.

Action and Therapeutics.

Spermaceti is used as an emollient and as a basis for ointments.

COD-LIVER OIL.

Oleum Morrhuae. The oil expressed from the fresh liver of the cod, *Gadus morrhua*, by a heat not exceeding 85°C. and from which the solid fat has been separated by filtration at −5°C. Norway coast.

Characters.—Pale yellow, with a slight fishy odour, and a bland fishy taste. Sp. gr. 0·920–0·930.

COMPOSITION.—The chief constituents are—(1) *Ole* (85 per cent), which is a fluid fixed oil, and is oleate o glyceryl, $C_3H_5(C_{18}H_{33}O_2)_3$. (2) Palmitin, myristin, and stear (10 per cent). (3) Free fatty acids, as oleic, palmitic, stearic (4) Trimethylamine. (5) Traces of iodine, bromine, bile-salts cholesterin, sulphuric acid and phosphoric acid. (6) Many alkaloids. Gaduin, which has been described, is probably a decomposition product. The composition of the morrhuol o commerce is uncertain.

Dose, 1 to 4 fl. dr.—4 to 16 mils.

ACTION.

External. Cod-liver oil is a bland unirritating oil. If it is desired to administer it in cases in which it is rejected by the stomach, it may be rubbed into the skin. The oil is certainly absorbed when applied in this way.

Internal. *Gastro-intestinal tract.* Cod-liver oil, even more than other oils, is liable to cause indigestion, nausea, and sickness. Large doses may set up diarrhœa. It is **more readily absorbed** than other oils. Loops of intestine have been isolated in the lower animals, and into each loop different oils have been injected. The intestines are returned to the abdominal cavity, and after some time the animal is killed and the loops are opened. It is always found that cod-liver oil has been more rapidly absorbed than any other oil. The facility with which cod-liver oil is absorbed is also shown by the fact that it often cannot be recognised in the fæces, although equal quantities of other oils taken by the mouth are passed unaltered. Some authorities believe that the superior absorbability of cod-liver oil depends upon the biliary principles contained in it, but this is doubtful; others think that it is because the presence of free acids facilitates saponification and emulsion. Certainly it contains more free fatty acids than other oils, and it also emulsifies much more easily.

Tissues. Not only is cod-liver oil more readily absorbed than other oils, but it is a better **food.** All oils lead to an increased formation of fat, but cod-liver oil is the most powerful in this respect. It reduces the colour of a solution of permanganate of potassium more readily than other oils—that is to say, it is more readily oxidized. Thus, as it is more easily absorbed and more easily oxidized, we have a partial explanation of its peculiar value in increasing the weight of the body; but the general belief is that these two facts do not wholly explain the action of cod-liver oil, and that it has some peculiar specific action not yet understood, especially upon those suffering from phthisis, for whom it may be a valuable drug.

THERAPEUTICS.

External. The smell of cod-liver oil is so disagreeable that it should not be rubbed in externally unless this treatment be absolutely necessary.

Internal.—Cod-liver oil is of great service in all varieties of tuberculous disease, the only contra-indications being high temperature, severe hæmoptysis, and dyspepsia, vomiting, or diarrhœa, whether primary or induced by the oil. Patients often improve in every way under its influence, and it has been shown to benefit tuberculous animals. With the same limitations it may be administered with great advantage in rickets, and in any chronic disease associated with loss of flesh, such as long-continued suppuration, convalescence from acute disease, tertiary syphilis, and starvation. It often is of benefit in the chronic bronchitis and the chronic eczema of childhood. It is frequently given with success in neuralgia, general feebleness, despondency, and other nervous conditions. Formerly it was often prescribed for chronic rheumatism. Many persons cannot, or imagine they cannot, take it on account of its nasty taste. There are in the market several preparations of cod-liver oil in which, by careful preparation, the disagreeable taste is almost abolished. Ten minims of pure ether with a drop or two of oil of peppermint or cloves will, when mixed with a dose of cod-liver oil, often render it more palatable. Sometimes it is taken in capsules, or made into a jelly with isinglass, or a little salt is put into the mouth after the oil is taken, or the mouth is rinsed out with brandy beforehand. Sometimes it is taken in coffee, or with orange juice, but the best way is to form an emulsion, for experiments have shown that the body utilizes it much better when given as an emulsion. A very nutritious one is made by rubbing together equal parts of maltine and cod liver oil, and in this the oil can hardly be tasted.

The B. P. C. has various useful emulsions of cod liver oil, *e.g.* Emulsio Olei Morrhuae (B. P. C.), in which it is emulsified with acacia and flavoured with oil of bitter almonds, Emulsio Olei Morrhuae cum Ferro (B. P. C.), which is the last mentioned with iron and ammonium citrate added, and Emulsio Olei Morrhuae cum Glycerophosphatibus (B. P. C.) There are several others. The dose of all is 2 to 8 fl. dr. (8 to 30 mils).

Ammonii Ichthosulphonas.—(Not official.)

Source. A bituminous quartz containing the fossil remains of fish and other animals is subjected to destructive distillation, the resulting oily product is called ichthyol. It is a viscid, brownish, almost black substance with a tarry odour and containing 10 per cent. of sulphur. Ammonium Ichthosulphonate consists of the ammonium salts of the sulphonic acids prepared from ichthyol.

Characters. A blackish-brown viscid liquid with a powerful characteristic odour.

Dose, 15 to 30 gr.—1 to 2 grms., in capsules.

Ichthyolsulphonates of [illegible], sodium, and zinc are prepared.

ACTION AND THERAPEUTICS.

Ammonium ichthosulphonate is chiefly used externally for chronic eczema and psoriasis. An ointment with lanolin and ammonium ichthosulphonate 10 per cent. (Unguentum Ichthamolis B. P. C.) is easily made. Unna's Ichthyol paste (starch 40, moisten with water 20, rub in ammonium ichthosulphonate 40, and add strong solution of albumen 1 or 1½) is recommended for acute eczema. Pasta Ichthamolis B. P. C. is a good preparation. Ichthyol has been given as a pill or in capsules thrice a day for chronic rheumatism.

HONEY.

Mel Depuratum. *Synonym.* Purified honey.

SOURCE. Melt honey in a water-bath, and strain through warm flannel while hot. Sp. gr. 1·36.

Preparation.

Oxymel.—Purified honey, 500; acetic acid, 100 water, 100. Sp. gr. 1·27.

Dose, 1 to 2 fl. dr.—4 to 8 mils.

Purified honey is contained in Confectio Piperis, Oxymel Scillæ, and Mel Boracis.

ACTION AND THERAPEUTICS.

Honey is demulcent, relieving dryness of the mouth and facilitating swallowing. Oxymel is a useful preparation. It is a common ingredient of cough mixtures. Honey is a mild laxative, and may be given to children for this purpose.

WAX.

Cera Flava. Yellow Beeswax. Prepared from the honeycomb of the hive bee, *Apis mellifica.*

CHARACTERS. Firm, yellowish. Odour honey like. Not unctuous. Soluble in oil of turpentine, not in alcohol. It is much adulterated with flour and paraffin.

COMPOSITION. It consists chiefly of (1) Myricin (Myricyl palmitate) $C_{30}H_{61}C_{16}H_{31}O_2$, 80 per cent. (2) Cerotic acid

Cera Alba. White Beeswax. Made by bleaching yellow beeswax.

USES.

Yellow and white wax are only used as basis for many plasters and ointments, and for Pilula Phosphori.

COCHINEAL.

Coccus.—Cochineal. The dried fecundated insec
Coccus cacti.

Characters.—Oval, flat or concave beneath, convex abov
about 5 millimetres long, transversely wrinkled, purplis
black or purplish grey, easily pulverized, the powder bein
dark red or puce-coloured.

Composition.—The chief constituent is the glucosid
carminic acid, $C_{17}H_{18}O_{10}$. Sulphuric acid and several othe
reagents precipitate from the decoction the well-know
colouring matter carmine.

Preparation.

Tinctura Cocci.—Cochineal, 1; alcohol (45 p
cent.), 10. Macerate.

Dose, 5 to 15 m. 3 to 10 decimils.

Cochineal is contained in the compound tinctures
cardamoms and cinchona.

Uses.

Cochineal is only used as a colouring agent.

CANTHARIDINUM.

Cantharidin. $C_{10}H_{12}O_4$.—May be obtained from
various species of Cantharis (Spanish Fly) or of Mylabris
Both are beetles.

Characters. Colourless glistening crystals, inodorous
Very slightly soluble but most soluble in fixed oils.

Preparations.

1. Acetum Cantharidini.—Cantharidin, 1
glacial acetic acid, 200; acetic acid, to produce 2000.

This is about the same strength as Acetum
Cantharidis B. P. 1898.

2. Emplastrum Calefaciens. — *Synonym.*
Warming Plaster. Cantharidin, 0·2; chloroform, 20;
olive oil, 40; resin plaster, 940.

This contains 0·02 per cent. of cantharidin, being
almost the same strength as Emplastrum Calefacien
B. P. 1898.

3. Emplastrum Cantharidini. Cantharidin,
25; chloroform, 100; yellow beeswax, 450; wool fat
to 1000.

This contains 0·2 per cent. of cantharidin, bein almost the same strength as Emplastrum Cantharidis B. P. 1898.

4. Liquor Epispasticus. – Cantharidin, 4 : castor oil, 25 ; resin, 12 ; acetone to 1000.

This is approximately the same strength as Liquor Epispasticus B. P. 1898.

5. Collodium Vesicans. — Pyroxylin, 25 : Cochineal, 10 ; Liquor Epispasticus to 1000.

6. Tinctura Cantharidini. Cantharidin, 0·1 ; chloroform, 10 ; alcohol (90 per cent.) to 1000.

Dose, 2 to 5 m. 12 to 30 centimils.

This is approximately the same strength as Tinctura Cantharidis B. P. 1898.

7. Unguentum Cantharidini. Cantharidin 0·1 ; chloroform, 10; benzoated lard, 290.

This contains 0·033 per cent. of cantharidin and is two-thirds the strength of Unguentum Cantharidis B. P. 1898.

In India benzoated suet should be used instead of benzoated lard.

ACTION.

External.—Cantharidin is a **powerful irritant**, but it is slower in its action than most. If any of its preparations is applied to the skin no effect is noticed for two or three hours ; then a tingling burning pain is perceived. Soon the part becomes red from vascular dilatation, the drug now producing its rubefacient effect. The next stage is the formation of several vesicles. These soon run together to form one large bleb full of clear serum. Not only is cantharides thus an **irritant and vesicant**, but it is a powerful **counter-irritant**, probably dilating by reflex action the vessels of the deep seated organs under the point of application.

Cantharidin can be absorbed by the skin in sufficient quantity to produce internal effects.

Internal.—Cantharidin is hardly used internally in medicine, as it is such a powerful irritant.

Gastro-intestinal tract.—It produces severe

gastro-intestinal irritation, the patient suffering from abdominal pain, diarrhœa, and vomiting, even if the drug is injected subcutaneously, showing that it is excreted by the gastro intestinal mucous membrane. There may be a burning pain in the throat; the motions and vomited matters may contain blood. These symptoms naturally cause much general depression.

Genito-urinary tract.—Cantharidin is absorbed into the blood, and a few hours after the gastro intestinal symptoms have set in the patient complains of great **pain in the loins** and strangury, that is to say, there is an urgent desire to micturate; the effort is very painful from vesical tenesmus, and the quantity of urine passed is very small; it may contain **albumen and blood.** In severe cases of poisoning there may be greatly increased sexual desire, numerous seminal emissions, violent priapism, with swelling and heat of the genital organs. In women cantharides may cause abortion or induce menstruation.

Post mortem. Intense **gastro-intestinal inflammation** is present, consequently swelling, ecchymoses, and hyperæmia of the mucous membrane of the alimentary canal are observed. The **kidneys are found to be very congested** and in the early stage of acute nephritis. There is also much inflammation of the genito urinary mucous membrane.

THERAPEUTICS.

External. Cantharidin is very largely employed to raise a blister, and it is of all drugs the most commonly used counter irritant. It is applied to the chest in pleurisy, over the pericardium in pericarditis, over the inflamed nerves in neuritis, over the mastoid process in disease of the ear, over joints with chronic effusion into them and over the stomach when there is gastric pain or vomiting. A blister applied over the nerve will often relieve pain in neuralgia. After the blister formed by cantharidin has burst some bland ointment should be applied. The cantharidin preparation should not be left on after the development of the bleb, lest the cantharidin should be absorbed. Cantharidin should not be applied to a part on which the patient lies, or a bedsore may form; nor must it be used in renal disease; and it should be carefully employed in children or debilitated persons. It ought not to be applied to paralysed limbs.

Cantharidin is the basis of many preparations the object of which is to stimulate the growth of the hair, such as the following, Acetum Cantharidini, ½ fl. oz. (15 mils); Glycerin, ½ fl. oz. (15 mils); Spiritus Rosmarini, ½ fl. oz. (15 mils); Water, 5 fl. oz. (150 mils).

Internal. The drug is rarely given internally.

LEECHES.

Hirudo. The Leech. Two species are official: (1) *Hirudo medicinalis*, the speckled leech (belly greenish yellow, spotted with black); (2) *Hirudo quinquestriata*, the green leech (belly olive-green, not spotted).

CHARACTERS. Body soft, smooth, five or more centimetres long, tapering to each end, plano-convex, wrinkled transversely with 90 to 100 fine annulations. Anterior extremity has small sucker with triradiate jaws, posterior extremity a large sucker. (1) Speckled Leech: dorsal surface olive-green, six longitudinal stripes, ventral surface greenish yellow with black spots. (2) Five-striped Leech: dorsal surface greenish-brown, with five longitudinal stripes; ventral surface greenish yellow not spotted. A good specimen will remove 1-2 fl. dr. of blood.

ACTION AND THERAPEUTICS.

Leeches are used to remove blood. They are usually applied over deep-seated organs when they are congested, and great relief is often afforde For example, three or four leeches over the liv when that organ is enlarged in heart disease, o one or two behind the ear when the tympanic cavi is inflamed, frequently do good. The leech bein applied to the skin, the animal fixes itself by i sucker-like disc, makes a triradiate cut with i mouth, and draws into its body, which consequentl becomes swollen, about a drachm and a half of bloo If this is not sufficient, a hot fomentation put o after the animal is removed may increase the quantity to half a fluid ounce. The skin should be we washed with a little milk before the leech is applie Occasionally the hæmorrhage requires pressure o some local styptic, as adrenalin, to stop it. I leeches have to be applied to the mouth, rectun or uterus, leech glasses, which allow only the hea to protrude, should be used.

Diphtheria Antitoxic Serum. (Not officia

When the bacillus of diphtheria grows in the body it produces toxins, albumoses, and an organic acid, and provoke the formation of a substance (called an antitoxin) which i found in the blood. This antitoxin is an antidote to th toxin of the diphtheria bacillus, it is largely owing to th production of it that the patient is enabled to survive, an his chances of surviving are enhanced if antitoxin is administered to him to aid that which is formed in his body.

SOURCE. Diphtheria bacilli are grown in a flask containing some nutrient broth (*e.g.* meat broth), to which 0·5 pe cent. sodium chloride and 2 per cent. commercial pepton have been added. At the end of some weeks the bacilli ar filtered off, and the fluid left contains a large amount o diphtheria toxin, which should be at least of such a strengt that $\frac{1}{10}$ c.c. of it will kill a good-sized guinea-pig. From $\frac{1}{2}$ to 1 c.c. of it is aseptically injected into the jugular vein of a horse: this produces slight symptoms. As soon as they ar past a larger dose is injected, and so the dose is graduall increased until 500 c.c. or more are given at each injection. This leads to the formation of a large amount of antitoxin in the blood serum. At the end of some months the horse is aseptically bled to 8 litres into a sterilized vessel, the blood coagulates, and the antitoxic serum is put into sterilized bottles and hermetically sealed, a little carbolic acid or other antiseptic being added to prevent decomposition.

The details may be modified, as horses vary in their reaction to the toxin, and toxins vary in strength, but the essentials of the method always remain the same.

Mode of Administration.—The antitoxic serum has been shown to be useless when given by the mouth, perhaps because it is destroyed in the liver. Therefore it is always injected subcutaneously; usually between the shoulders or on the side of the abdomen. Before injection the skin should be thoroughly washed with an antiseptic, and all ordinary antiseptic precautions should be taken. After injection the puncture should be sealed with antiseptic gauze, iodoform and collodion. The antitoxin for each injection should be taken from a fresh bottle. A special syringe, so constructed that all the parts of it can be boiled before use, is employed. It is best made entirely of glass. The barrel and piston should be boiled separately or else they may crack. It should hold 10 c.c. The needle is 2 or 3 inches long. It should be fine, as then the puncture is less painful. Both needle and syringe should cool before use, or the antitoxin may coagulate.

Dose.—It is better to give a small dose of a concentrated than a large dose of a dilute antitoxin; but the initial dose should be large (for an infant 2000 units, for an older patient 3000 or 4000), so as to quickly neutralize all the toxin. If the illness has lasted more than twenty-four hours larger doses should be given. The antitoxin should be as fresh as possible. All antitoxins deteriorate by keeping. The strength, which is stated on the bottle, varies between 200 and 2500 units per cubic centimetre, but usually it is about 500. The antitoxin must be obtained from a reliable source, and the more concentrated is to be preferred, for probably some of the ill-effects that occasionally follow are due to the serum of the horse with which the antitoxin is mixed. The quantity given should be such that from 4000 to 12,000 units or even more are injected in the first twenty-four hours after the patient comes under treatment. This amount may be divided into two or three doses, and should be repeated on the second and third days if necessary, but as far as possible a single sufficient dose is better than several smaller doses. A unit is the smallest quantity of antitoxic serum which, when mixed with a certain quantity of a standard diphtheritic toxin and with it injected into the subcutaneous tissue of a healthy guinea-pig weighing from 250 to 300 grammes, protects the animal from death within four days.

It is impossible in a work like this to give a more pre
definition, for all diphtheritic toxin consists of toxin pro
which is poisonous, and toxoid bodies which although
poisonous will neutralize the antitoxic properties of antito
serum. Therefore to standardize antitoxic serum it must
tested against diphtheritic toxin in which the proportion
toxins proper and toxoids and the neutralizing activity of
latter on toxin and antitoxin are all known and constant. Su
a standard toxin is kept in the Government testing depa
ment at Frankfort on the Main, and the strength of all dip
theritic antitoxins should be expressed in terms of it.

ACTION AND THERAPEUTICS.

Antitoxic serum diminishes all the symptoms
diphtheria, and in particular it greatly lessens t
liability to sudden cardiac failure. If the diphther
toxin be administered to animals fatty degeneratio
of the heart is found after death, but if they hav
also had antitoxin this is absent. Both clinical an
experimental evidence shows that after antitoxin
given, although the bacilli continue to exist in th
throat, the formation of membrane ceases and tha
which is present rapidly disappears; therefore laryn
geal diphtheria rarely follows faucial if antitoxin
used early, the patient becomes less anæmic, h
pulse improves, and his temperature may fall
little, although this is less influenced by antitoxi
than are the other symptoms of diphtheria. Th
maximum effect of the antitoxin is not seen til
twenty-four hours after injection. All reliable col
lections of cases show that the mortality, especiall
in children, is much less when the antitoxin i
used. It should be given at the earliest possibl
moment, even if it is only likely that the patient i
suffering from diphtheria, for the number of fata
cases is less when antitoxin is used early in the ill
ness. The benefit is more marked in laryngeal than i
other varieties of diphtheria, the mortality of tracheo-
tomy cases falling by one half. The frequency of

the occurrence of paralysis is not diminished, but the percentage of recoveries in cases with paralysis is slightly increased. When a case of diphtheria is discovered in a school, the other children who have been associated with the patient should have 500 units given to each as a preventive. The protection conferred lasts about three weeks. Such preventive treatment is especially useful for any suffering from measles or scarlet fever, for in both these diphtheria is a dangerous complication.

Poisoning symptoms are sometimes seen after any antitoxic serum has been given, but they are usually unimportant and very rarely severe. When they are present the patient is said to be suffering from anaphylaxis. They are not due to the antitoxin, but to some other constituent of the serum, for they may follow when the simple serum of animals is injected into the human subject. The most common is a rash, met with in about 35 per cent. of the patients injected; it may appear as late as the end of the third week after injection, but it is usually seen at the end of the first week. In a few cases a second rash is observed after the first has faded. Usually it is a mere erythema, but it may be papular or urticarial. Commonly it disappears in three days. Pains in the joints and slight swelling of them are occasionally present, and sometimes slight pyrexia is seen. These symptoms are most likely to appear if a second dose is given, even if it is quite small. It is said that they may often be benefited by 15 gr. of calcium lactate three times a day by the mouth.

Meningococcic Antitoxic Serum. (Not official.)

Epidemic cerebrospinal meningitis is caused by the diplococcus meningitidis. Horses are repeatedly injected with various strains of this bacillus. At the end of four or five months their serum is sufficiently antitoxic to be of use. Some cerebrospinal fluid is withdrawn from the patient by lumbar puncture and is replaced by 15 to 30 c.c. of the seru repeated daily till the patient recovers. This serum not onl acts as an antitoxin, but it destroys the offending micr organisms. Its use has very greatly diminished the mortalit of cerebrospinal fever.

Tetanus Antitoxic Serum. (Not official.)

This is prepared on the same principles as diphtheri antitoxin (*q.v.*). We know that the tetanus toxin links itse closely to the proteins of the cells of the central nervous syste and that when it passes from a wound to the central nervou system it travels along the protoplasm of the nerves. Unfortunately this linking takes place almost coincidently with th appearance of symptoms, and when once the linking ha occurred no amount of antitoxin can dislocate it. Henc antitoxin, to be any use, must be given very early in th disease. It has been injected directly into the brain i the hope that it may meet and neutralize the toxin befor that reaches the nerve cells, or perhaps unite with the cell and thus prevent the toxin from doing so. A small cut i made down to the bone, which is bored with a drill, and th antitoxin is directly injected into the cerebrum with a blun needle. Different specimens of the antitoxin vary in strengt but a full dose of a concentrated variety should be used. I is also given subcutaneously, intravenously, directly into th nerve from the wound, and subdurally, but it is not certai which method is the best; injection into the brain is rarel done now. No very striking success has attended its use i man, perhaps because tetanus is not usually diagnosed till long after infection, and perhaps because, as just pointe out, the tetanus toxin is soon very firmly united with th proteids of the central nervous system; but in an undoubte case it is well to give the treatment a trial, using as muc as 150,000 to 200,000 units for a dose.

There is however much more hope that it may benefit if it is given directly after a patient has a wound which is likel to contain tetanus bacilli, *i.e.* such a wound as is contaminated with soil. In the present war many English soldier receive as a preventive 1500 units subcutaneously as soo as is possible after the infliction of a dirty wound, and if this injection is very soon after the wound there is ever hope that cases of tetanus usually so common in war will b very few.

Antipneumococcic Serum. (Not official.)

This is prepared in the same way as antistreptococci serum (p. 692), and like it is bactericidal, not antitoxic. It has been used for diseases due to the pneumococcus, but the evidence of its efficacy is very slight.

Antivenomous Serum. (Not official.)

The only antitoxic serum against snake bite that is sold is the antivenene prepared by Calmette. It is made from the horse in the same way as diphtheria antitoxin. It is antitoxic to cobra poison, and is in practice efficacious; probably it is useless for bites by other snakes, but as this is uncertain it should always be given. The serum that is much wanted is a polyvalent one, efficacious for bites by all species of poisonous snakes. Antivenomous serum is given hypodermically.

Antithyroid Serum.—(Not official.)

This is the blood serum of rams upon whom thyroidectomy has been performed six weeks previously. It is usually known as Moebius's Antithyroid Serum. The dose is 5 m (3 decimils) increased to 30 m (18 decimils) three times a day by the mouth. It is given for exophthalmic goitre. This treatment appears sometimes to benefit the disease. Rodagen is a white powder consisting of the dried milk of goats whose thyroid has been removed. Milk sugar is added as a preservative. It has been tried for exophthalmic goitre; about 100 grains (7 grm.) a day is given.

Hay Fever Antitoxin.—(Not official.)

Hay fever is due to a toxin contained in the pollen of rye and other grasses. It is soluble, and is thus dissolved by the nasal secretions. Dunbar, by inoculating rabbits, prepared an antitoxin to it. This antitoxin is now made by inoculating horses. It is called pollantin. Immediately the sufferer from hay fever feels an attack coming on he applies a drop or two of the antitoxin with a pipette to the eye or nose. This treatment often cuts short the disease.

Antidysenteric Serum. (Not official.)

This has been prepared by inoculating a horse with various strains of Shiga's or Flexner's bacillus. It certainly seems to be of use in the treatment of bacillary dysentery, using the serum corresponding to the bacilli causing the disease, but it is of course useless for amœbic dysentery for which disease we have a specific in emetine (q.v.). Usually 20 to 40 c.c. are given subcutaneously for two or three days

Antiplague Serum. (Not official.)

This is prepared by inoculating a horse with plag
bacilli. Its action is bactericidal as well as antitoxic
appears to do good in some cases. Usually 50 c.c. are give
intravenously, followed by two doses of 50 c.c. subcutaneou
in 24 hours and smaller doses during the next few day

Antistreptococcic Serum.—(Not offi

Streptococci do not cause the septic diseases due to the
by developing a toxin which circulates in the blood, but b
being themselves carried all over the body, which attempts t
kill them by developing specific bactericidal bodies fatal t
them. To prepare antistreptococcic serum the virulence
streptococci is increased by their passage through sever
rabbits; they are then grown on a medium which preserv
their virulence. A horse is next treated with successive dos
of cultivations of these living streptococci, each more pote
than the former. At the end of a year the serum of the hors
is toxic enough to streptococci for use. The dose varies wit
different specimens of serum. It is always given subcuta
neously.

Antistreptococcic serum suggests itself as useful for thos
diseases which are principally due to infection by streptococc
Such are malignant endocarditis, erysipelas, surgical septi
cæmia, disease of the middle ear, thrombosis of the latera
sinus, and puerperal septicæmia. A few successful cases hav
been recorded of its use in these disorders, but the disappoint
ments have been so numerous that it is doubtful whether it doe
good. One great disadvantage of it is that cultivations fro
different sources of apparently identical streptococci vary
widely in their properties that serum which is bactericidal t
one cultivation is not to another. This difficulty may, to som
extent, be overcome by using one of the polyvalent sera on th
market.

Coley's fluid, a mixture of the toxins of streptococcu
erysipelatosus and bacillus prodigiosus, has been injected fo
sarcoma and carcinoma, as these growths sometimes lesse
after an attack of erysipelas, and occasionally it does rea
good.

Streptococcic Vaccine.—(Not official.)

When a patient suffers from a disease due to bacteria
and recovery ensues, this is because various substances
called anti-bodies, are already present or are developed in
his blood, which are harmful to the bacteria (*e.g.* agglu-

inins, which cause clumping of them; bacteriolysins, which destroy them), or antagonize the toxins produced by them and to the fact that the phagocytes in his blood destroy the bacteria. The ability of the phagocytes to destroy the bacteria is believed to be exalted by the development in the blood of certain substances called [illegible] p. 694), which render the bacteria particularly vulnerable to the phagocytes. Often the patient fails to get well [illegible] his power of developing these modes of resistance [illegible]ot sufficient. In such a case it sometimes appears that by injecting subcutaneously into the patient dead bacteria of the variety causing his disease [illegible] resistance are excited, and thus recovery [illegible]. A preparation of [illegible] for such a purpose [illegible] a vaccine, and the [illegible] expressed as the number of bacteria injected, e.g. we [illegible] of 5,000,000 of streptococcal or gonococcal [illegible]. In the case of tuberculin (see p. 694) the vaccine consists of an extract of the dead bacilli. If the patient is severely and recently ill with a high temperature he is [illegible] considerably poisoned by the bacteria or their toxins which are causing his disease that the administration of a vaccine will only make matters worse, hence they should not be [illegible]ed at all, or at least in very small doses; but if the disease has lasted some time much good may sometimes be done by giving a vaccine which presumably acts by raising the various means of resistance to the micro-organism causing his disease. The attempt is often made to use frequent estimations of the opsonic index (see p. 695) as a guide to the desirability of giving a vaccine, to the dose required, to the repetition of the dose, and to the progress of the case, and in the hands of highly trained observers the opsonic index may be a guide; but the fallacies in the estimation of it are numerous and in any particular case the observations should be made by the same skilled observer under similar conditions. The general condition of the patient—his temperature, pulse, and gain in weight—are also indications, and usually sufficient indications, as to whether vaccine treatment should be continued. Owing to the harm that may follow from a severe negative phase (*see* p. 696) several days' interval must always elapse between the administration of each dose of vaccine, and a patient is usually much more likely to benefit if the vaccine is prepared from the actual offending micro-organism derived from him rather than from a stock cultivation of the same variety of micro-organism.

Many cases of long-continued suppuration, *e.g.* ar empyæma, the pus of which is being coughed up, may b much benefited by the use of a vaccine. Usually som variety of streptococcus is present in the pus, and from thi variety the vaccine is prepared. The initial dose for an adul is 5 to 20 millions. The worse the general condition of th patient the smaller should be the initial dose. Unless th negative phase is being observed by reliable observation o the opsonic index, a second dose should not be given unti seven days have elapsed. The cases which do best are thos in which there is a single abscess. If the infection is general *e.g.* severe pyæmic, with multiple abscess, or malignant endocarditis, there is little hope that good will follow the use o vaccines. If more than one pathogenic micro-organism ca be cultivated from the pus, a vaccine prepared from each may be used.

Tubercular Serums and Vaccines. (Not official.)

Maragliano, Marmorek, and many others have attempted to make antitubercular serums which shall be as beneficial to those suffering from tubercle as antidiphtheric serum is to those suffering from diphtheria. None of these serums are sufficiently valuable to have come into general use.

Koch found that by growing tubercle bacilli under certain conditions, the fluid in which they grew contained their toxins. He called the fluid remaining after the bacilli were filtered off tuberculin, now usually called old tuberculin, the abbreviation for which is T. It is virtually a solution of the toxins in the glycerin in which the bacilli grew. It is a thick dark yellow fluid.

No effect follows if this is injected into a healthy person, but if he has a tubercular disease, the injection produces a high temperature, rigors, a feeling of illness, pains in the joints, sometimes albuminuria and rashes on the skin, and at the same time the tubercular lesion is stimulated into activity. These dangerous results forbid the use of this tuberculin for man; the only disease for which its employment might be justified is lupus of the skin, for there the local reaction in the lesion can be watched, and lupus is so chronic that sometimes the stimulation may be useful; but tuberculin is rarely employed even for lupus.

As the febrile reaction only occurs when the injected subject has tubercular disease, tuberculin is often injected into cattle to see if they are tuberculous, but its use for this purpose is unjustifiable in man.

Koch has also prepared an aqueous extract of dried highly virulent tubercle bacilli. He calls the upper layer of this extract Tuberculin O., or shortly T.O. (Oberer Tuberculin). It is rarely used, and its action is the same as that of old tuberculin. The lower layer is dried and re-extracted several times; the final extract is called new tuberculin, T.R. (T. Ruckstand). It produces no visible effects upon healthy people, but when injected in any but minute doses into those suffering from tubercle it leads to the same general reaction as old tuberculin, but usually produces no local reaction upon the tubercular lesion. New tuberculin is rarely used for diagnosis in cattle, and should never be used for this purpose in man. It is the tuberculin most used therapeutically in man, but a bacillary emulsion (B. E.) is sometimes given. Neither has been proved to have a beneficial therapeutic effect for tubercular disease, but some consider either useful for chronic varieties; but they can hardly be said to have proved this. Many think tuberculin often does harm, and unless used with judgment it may produce undesirable general reaction, and speaking generally tuberculin is not now thought to have the high therapeutic value formerly attributed to it. If not carefully prepared it may contain living tubercle bacilli.

Wright and others claim that tuberculin injections are beneficial provided that the opsonic power of the blood is watched. Opsonins are bodies contained in the serum of the blood; they so modify bacilli as to render them an easy prey to phagocytes. The strength of the blood in opsonins which thus modify tubercle bacilli is tested by mixing in a capillary pipette an equal quantity of the blood serum, an emulsion of tubercle bacilli, and blood corpuscles washed with one per cent. sodium citrate solution in normal saline. The mixture is incubated for twenty minutes, films are made. The average number of tubercle bacilli ingested by each polynuclear white corpuscle is calculated and contrasted with the number thus ingested when healthy blood serum is used. This latter is taken as unity, and the opsonic index is the ratio of the number ingested when the blood serum of the tubercular patient was used compared with the number ingested when healthy serum was used. It is believed that when the patient has a high opsonic index he is more likely to recover than when this is low. Wright injects either tuberculin R or a tuberculin he himself prepares, carefully sterilized. The dose is $\frac{1}{[illegible]}$ mg. The first effect is to lower the opsonic power of the blood. This fall is slight in a healthy person, greater if he be the subject of tubercle; it is called the negative phase, and lasts about a week in a tubercular subject, much less in a healthy person. It is followed by a rise, and in two or three weeks the opsonic index is higher than before injection (positive phase). If a second injection is made during the negative phase much harm is done, because the patient's opsonic power is seriously reduced for a long time; but if a second injection is given during the positive phase his opsonic power is much strengthened. To treat a tuberculous patient with tuberculin his opsonic index is taken. If it is above normal, we conclude that he has already in self-defence raised the opsonic power of his blood against tubercle, and so vaccinating him at this stage with tuberculin will not do much good; but if his opsonic index is normal, or below normal (variations between 1·2 and 0·8 are within normal limits), we inject $\frac{1}{1000}$ mg. of tuberculin (or in other words vaccinate him with the vaccine tuberculin), take his opsonic index from time to time after, and during the positive phase give a second injection, and so on. As a rule the second injection is required three weeks after the first, and the third three weeks after the second. Tuberculin, like other vaccines, is often given without observations of the opsonic index (*see* p. 693); if so, sufficient time must be allowed between the doses to avoid the negative phase. Some think that this treatment is of use in phthisis, many think it useless, and some believe it to be harmful; it occasionally appears to aid the cure of local tuberculosis, especially that of the bladder, skin, and lymphatic glands. If too large doses are given, or if a subsequent dose is given during a negative phase, we see the same evil effects that were observed when tuberculin was first employed by Koch. Lately tuberculin has been given both by the mouth and rectum, but this is probably useless.

Plague Vaccine.—(Not official.)

An emulsion of dead plague bacilli (Bacillus pestis) artificially grown in broth, originally prepared by Haffkine, has been largely used to vaccinate those exposed to plague. Those thus vaccinated rarely contract plague when exposed to it, especially if they have had two inoculations, and if they suffer from plague the attack is less severe.

Cholera Serum and Vaccine.—(Not official.)

This serum is of no therapeutic value, but there is evidence that vaccination with cholera micro-organisms affords some protection. The only vaccines used largely are those prepared by Haffkine. They may be used for those about to go to a place where an outbreak of cholera exists, but not for those already in the midst of an outbreak, because for a time it renders those inoculated more susceptible.

Typhoid Serum and Vaccine. (Not official.) There is no evidence that the serum treatment of typhoid fever is of benefit.

Wright has perfected a method of vaccination or inoculation against typhoid fever by injecting dead typhoid bacilli subcutaneously or intramuscularly with all antiseptic precautions. They are usually injected into the abdominal wall or the upper part of the arm. The dose is 500 millions. Local inflammatory reaction with some pyrexia follows in a few hours, but usually soon passes off. Therefore it is best to give the injection in the evening and keep the patient in bed the next day. A second vaccination of 1000 millions is usually performed ten days after the first. The blood serum of an inoculated person clumps typhoid bacilli for at least six months after an inoculation, and these inoculations render those inoculated much less susceptible and lower the rate of mortality among those who, although inoculated, acquire the disease. Inoculation should not be practised upon those in the midst of an outbreak of typhoid fever, because for a short time after inoculation the susceptibility to typhoid is enhanced. But those going to a ountry where typhoid is rife should be inoculated before oing. All soldiers should be inoculated before a campaign.

Hydrophobia Vaccine. (Not official.) A rabbit is inoculated from the spinal cord of an animal dead of hydrophobia, other rabbits are inoculated from the spinal cord of this, and so through a series until the spinal cord (which is the chief seat of the virus in hydrophobia) contains a virus the incubation period of which is seven days. The spinal cord loses its virulence when exposed to the air, so that a series of spinal cords (each of which originally contained a virus the incubation period of which was seven days) can be prepared of greater or less virulence according to the time during which they have been exposed to the air. It is found that if a patient who has been bitten by a rabid dog is inoculated first with a rabbit's spinal cord of a low degree of virulence, and next day with one of a higher degree, and so on increasing the virulence of the injection, hydrophobia does not usually develop in him if the treatment is begun soon after the bite. The most convenient place (for the inhabitants of Great Britain) where the treatment is carried out is the Pasteur Institute in Paris, and if the person bitten go immediately after the bite it is almost certain he will not suffer from hydrophobia. The incubation period of hydrophobia is fortunately several weeks, and hence if the above treatment is carried out it renders the patient immune before the incubation period expires.

Staphylococcal Vaccine.—(Not official.)

This consists of dead staphylococcal bacilli; it is one of the most useful vaccines, and is employed for diseases, generally suppurative, due to staphylococci. Boils and acne are often cured by the administration of a vaccine made from the staphylococci in them. The dose, usually given in the same way as the typhoid vaccine, is 50 to 200 millions. If a fortnight is allowed to elapse between each dose, it is hardly necessary to take the opsonic index.

Colon Vaccine.—(Not official.)

Many febrile disorders, *e.g.* certain cases of cystitis, pyelitis, ulcerative colitis, and even suppuration in the chest, are due to the bacillus coli communis. They may often be strikingly benefited by the use of a vaccine prepared from the patient's own variety of colon bacillus. The dose usually varies from 5 to 50 millions. It is given in the same way as the typhoid vaccine.

Gonorrhœal Vaccine.—(Not official.)

This is very useful for chronic gleet and chronic gonorrhœal arthritis and rheumatism. As in so many other instances an autogenous vaccine is preferable to a stock vaccine. It is given in the same way as the typhoid vaccine. The first dose is usually 2½ millions, subsequent doses are 5, 10, and 25 millions.

A pneumococcal vaccine has been employed in some cases of pneumococcal infection. The general principles mentioned under the heading of streptococcal vaccine apply to all other vaccines. They often fail in cases in which much was hoped from them—the reasons why this should be so are too numerous to detail here—but on the other hand they frequently succeed in intractable cases which have resisted all other treatment, and as, when properly used in chronic infections, they hardly ever do harm, they may well be tried together with, if necessary, other appropriate treatment, *e.g.* local treatment of pyorrhœa.

Yeast.—(Not official.)

The opsonic power of the blood may be increased by giving yeast. The dose is 5 to 10 grammes in milk. As with tuberculin, so with yeast, the first effect is a drop in the opsonic index; the drop is followed in a few days by a rise. An increase in the leucocytes of the blood also follows quickly giving yeast. It is not known to what constituents these effects are due, but it has been suggested they are due to the nucleic acid in the yeast. Boils are sometimes successfully treated by the administration of yeast; perhaps then the opsonic power of the blood in regard to the micro-organisms causing the boils is raised by the yeast. Nucleic acid, as it stimulates the formation of white cells in rabbits, has been given in various bacterial diseases and also by surgeons before serious abdominal operations, in order that the larger number of leucocytes should help to defend the body against micro-organisms which may cause acute peritonitis, but it seems to do but little good in man. Nucleic acid is best given subcutaneously in doses of 15 ♏ (1 mil) of a 5 per cent. solution of the sodium salt. It is sometimes called nuclein, a name also given to the residue obtained by the extraction by acids of pus, yeast, or spermatozoa. This residue contains much nucleic acid. For the nucleic acid derived from the thymus see p. 672.

APPENDIX No. I.

A LIST OF LATIN PHRASES COMMONLY USED IN THE WRITING OF PRESCRIPTIONS.

āā.	Ana	of each.
Ad.	Adde	add.
Ad lib.	Ad libitum	to the desired amount.
Ad us.	Ad usum	according to custom.
Æq.	Æquales	equal.
Aq.	Aqua	water.
Aq. bull.	Aqua bulliens	boiling water.
Aq. dest.	Aqua destillata	distilled water.
Bib.	Bibe	drink.
Bis ind.	Bis indies	twice a day.
Bis in 7 d.	Bis in septem diebus	twice a week.
C.	Cum	with.
Cap.	Capiat	let him take.
C. m.	Cras mane	to-morrow morning.
C. m. s.	Cras mane sumendus	to be taken to-morrow morning.
C. n.	Cras nocte	to-morrow night.
Cochl.	Cochleare	spoonful.
Cochl. ampl.	Cochleare amplum	a table-spoonful.
Cochl. infant.	Cochleare infantis	a tea-spoonful.
Cochl. mag.	Cochleare magnum	a table-spoonful.
Cochl. mod.	Cochleare modicum	a dessert-spoonful.
Cochl. parv.	Cochleare parvum	a tea-spoonful.
Contin.	Continuetur	let it be continued.
Cuj.	Cujus	of which.
C. v.	Cras vespere	to-morrow evening.
Cyath.	Cyathus	a glassful.
Cyath. vinos.	Cyathus vinosus	a wine-glassful.
D.	Dosis	a dose.
d.	Da	give.
D. d. in d.	De die in diem	from day to day.
Det.	Detur	let it be given.
Dieb. alt.	Diebus alternis	on alternate days.
Dim.	Dimidius	one half.
Div.	Divide	divide.
D. in p. æ.	Divide in partes æquales	divide into equal parts.
Exhib.	Exhibeatur	let it be given.
F. or ft.	Fiat	let it be made.
F. h.	Fiat haustus	make a draught.
F. m.	Fiat mistura	make a mixture.
F. pil.	Fiat pilula	make a pill
Gutt.	Gutta or guttæ	drop or drops.
Habt.	Habeat	let him have.
Hor. intermed.	Horis intermediis	at intermediate hours.
H. s.	Hora somni	at bedtime.
Ind.	Indies	daily.
Lat. dol.	Lateri dolenti	to the painful side.

Mit.	Mitte	send.
Mod. præscript.	Modo præscripto	in the manner directed.
Oct. pars	Octava pars	an eighth part.
O. m.	Omni mane	every morning.
Omn. bih.	Omni bihora	every two hours.
Omn. hor.	Omni horâ	every hour.
O. n.	Omni nocte	every night.
P. or pt.	Perstatur	continue.
Part. æq.	Partes æquales	equal parts.
P. r. n.	Pro re nata	when required.
Q. l.	Quantum libet	as much as is requisite.
Q. s.	Quantum sufficit	a sufficient quantity.
Q. v.	Quantum volueris	at will.
Quart. pars	Quarta pars	a quarter.
R.	Recipe	take.
Rep.	Repetatur	let it be repeated.
Sing.	Singulorum	of each.
Sum.	Sumat or sumendum	let him take or let it be taken.
T. d.	Ter in die	three times a day.
T. e quat. part.	Tres e quattuor partibus	three quarters.

APPENDIX No. II.

ALTERNATIVE PREPARATIONS SANCTIONED FOR USE IN TROPICAL, SUBTROPICAL, AND OTHER PARTS OF THE BRITISH EMPIRE.

Aquæ Anethi, Anisi, Carui, Cinnamomi, Fœniculi, Menthæ Piperitæ, Menthæ Viridis. —Each of these waters may be prepared by triturating the corresponding oil with twice its weight of calcium phosphate and 500 times its volume of distilled water and filtering.

Emplastra. —More or less hard soap, resin, or yellow beeswax, may be employed in the preparation of these in the text of the Pharmacopœia when prevailing high temperatures render the basis too soft for convenient use; but the official proportion of the active ingredient must be maintained.

Extracta Liquida. —Any Pharmacopœial liquid extract containing less than ¼ its weight of alcohol (90 per cent.) may have the proportion increased to an amount not exceeding ¼ when otherwise the preparation would be liable to ferment.

Limonis Cortex Siccatus.—If fresh lemon peel cannot be obtained, dried lemon peel may be used in preparing compound infusion of orange peel, compound infusion of gentian, syrup of lemon and tincture of lemon.

Oleum Olivæ.—In India, and in the Eastern, African, Australasian, and North American Divisions of the Empire, arachis oil or sesame oil may be employed in making the official liniments, plasters, ointments, and soaps, for which olive oil is directed to be used.

Suppositoria.—More or less white beeswax, according to prevailing temperatures, may be used in place of an equivalent amount of oil of theobroma where otherwise the Pharmacopœial suppositories would be too soft.

Syrupus Rhœados. If prevailing high temperatures render this liable to ferment, the proportion of alcohol (90 per cent.) may be increased, but not to more than double the proportion stated in the Pharmacopœia, an equivalent quantity of distilled water being omitted.

Unguenta. More or less benzoated lard, prepared lard, benzoated suet, yellow beeswax or white beeswax, may be employed in the preparation of the Pharmacopœial ointments when prevailing high temperatures render the basis too soft for convenient use; but the official proportion of the active ingredient must be maintained.

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